

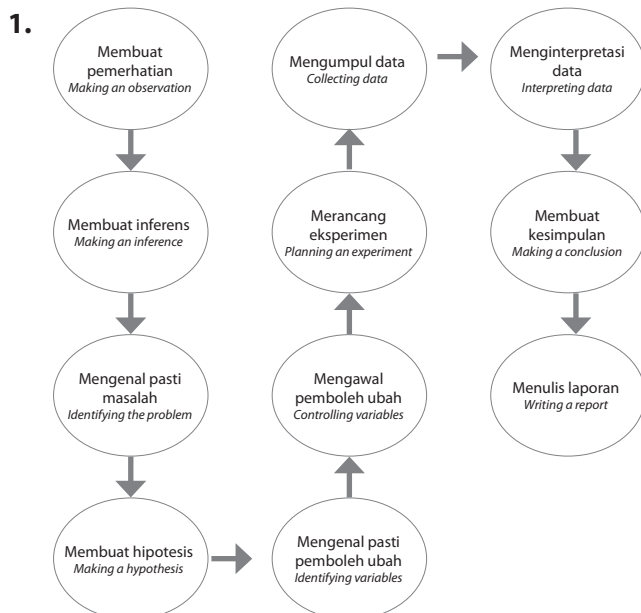
Perkembangan Bidang Kimia dan Kepentingan dalam Kehidupan

1.1 Development in Chemistry Field and Its Importance in Daily Life

1. struktur, sifat, komposisi, interaksi antara jirim
structures, properties, composition, interactions between matters
2. • Sutera / *Silk*
• Garam biasa / *Table salt*
• Grafit / *Graphite*
• Enzim / *Enzyme*
• Getah asli / *Natural rubber*
3. • Baja kimia / *Chemical fertilisers*
• Ubat-ubatan moden / *Modern medicines*
• Daging proses / *Processed meats*
4. (a) Doktor / Ahli farmasi / Doktor gigi
Doctor / Pharmacist / Dentist
(b) Ahli sains pemakanan
Food scientist
(c) Ahli kimia / Jurutera kimia
Chemist / Chemical engineer
(d) Guru / Pensyarah
Teacher / Lecturer

1.2 Penyasiatan Saintifik dalam Kimia

Scientific Investigation in Chemistry



2. Tujuan

Aim

Pernyataan masalah

Problem statement

Hipotesis

Hypothesis

(a) dimanipulasikan
manipulated

(b) bergerak balas
responding

(c) dimalarkan
fixed

Bahan

Materials

Radas

Apparatus

Suhu (°C) <i>Temperature (°C)</i>	Pemerhatian <i>Observation</i>
10	Garam tidak larut <i>Salt does not dissolve</i>
30	Garam separa larut <i>Salt partially dissolves</i>
80	Garam larut sepenuhnya <i>Salt dissolves completely</i>

Garam larut sepenuhnya di dalam air pada suhu 80 °C.
Salt dissolves completely at the temperature of 80 °C.

Suhu air mempengaruhi keterlarutan garam di dalam air. Hipotesis diterima.

Water temperature affects the solubility of salt in water. Hypothesis is accepted.

Penggunaan, Pengurusan dan Pengendalian Radas serta Bahan Kimia

1.3 Usage, Management and Handling of Apparatus and Materials

1. (a) Topeng muka
Face mask
(b) Kaca mata keselamatan
Safety goggles
(c) Sarung tangan
Gloves
(d) Baju makmal
Laboratory coat
(e) Kasut makmal
Laboratory shoes

2.

(a)



Untuk membersihkan badan apabila kemalangan berlaku pada badan dan pakaian
To clean the body when an accident occurs on the body and clothing

(b)



Untuk memadamkan kebakaran di makmal
To extinguish fire in the laboratory

(c)



Untuk menjalankan eksperimen yang membebaskan wasap beracun, berbau sengit atau mudah terbakar
To carry out experiments that release toxic fumes or pungent smells or flammable

(d)



Untuk membersihkan mata jika berlaku kemalangan pada mata
To clean eyes if an accident occurs to the eyes

Digunakan untuk mencuci tangan
To wash hands

3. (a) Benar / True
(b) Palsu / False
(c) Benar / True
(d) Palsu / False
(e) Benar / True

4. (a) 4 (b) 3 (c) 5 (d) 2 (e) 1

5. (a) Pelarut organik dan hidrokarbon
Organic solvent and hydrocarbon
(b) Bahan meruap
Volatile substances

(c) Bahan yang mempunyai pH<5 dan pH>9
Substances with pH<5 and pH>9

(d) Logam berat dan bahan toksik
Heavy metals and toxic substances

6. (a) guru; pembantu makmal
teacher; laboratory assistant
(b) kawasan larangan
prohibited area
(c) pasir
sand
(d) sulfur
sulphur



KBAT EKSTRA BAB 1

1. (a) Luas permukaan zarah nano yang sangat besar membantu menyelesaikan masalah yang tidak dapat diselesaikan secara fizikal, masalah racun perosak kimia dan kawalan biologi.

The extremely large surface area of nanoparticles helps to solve the problems that cannot be addressed physically, chemical pesticides and biological control problems.

- (b)
- Baja nano merangsang pertumbuhan tanaman.
Nanofertilisers stimulate plants growth.
 - Racun perosak-bio nano mudah diserap ke dalam badan haiwan perosak. Hal ini dapat mengurangkan penggunaan racun perosak kimia yang bersifat toksik.
Bio-nano pesticides are easily absorbed into the body of pests. This can reduce the use of toxic chemical pesticides.
 - Bahan nano meningkatkan toleransi tumbuhan terhadap tekanan dan memperbaiki kualiti tanah.
Nanomaterials promote plant stress tolerance and improve soil quality.
 - Nanosensor dapat mengesan kelembapan tanah, sisa racun perosak, keperluan nutrien dan perosak tanaman.
Nanosensors can detect the humidity of soil, pesticide residue, nutrient requirement and crop pest.

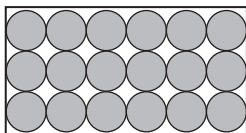
2.1 Konsep Asas Jirim Basic Concepts of Matter

- Molekul / *Molecule*
 - Peleburan / *Melting*
 - Ais kurang tumpat daripada air. Susunan molekul air lebih padat dalam keadaan cecair berbanding dengan keadaan pepejal.
Ice is less dense than water. Arrangement of water molecules is more packed in liquid state compared to solid state.
 - Permukaan gelas yang sejuk menyebabkan wap air di udara kehilangan haba dan mengalami kondensasi. Wap air bertukar daripada gas kepada cecair.
Glass surface that is cold causes water vapour in the air to lose heat and undergoes condensation. Water vapour turns from gas to liquid.

(e) Cecair / *Liquid*

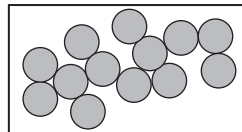
- Unsur
Element
 - Atom / *Atom*
 - Molekul / *Molecule*
 - Sebatian
Compound
 - Molekul / *Molecule*
 - Ion / *Ion*

3. Pepejal / *Solid*



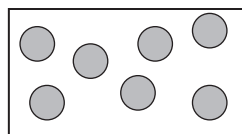
- Zarah disusun secara padat dan teratur
Particles are closely packed in an orderly manner
- Zarah hanya bergetar pada kedudukan yang tetap
Particles only vibrate at fixed position
- Tenaga kinetik adalah rendah
Kinetic energy is low
- Daya tarikan antara zarah kuat
Strong attraction forces between particles

Cecair / *Liquid*



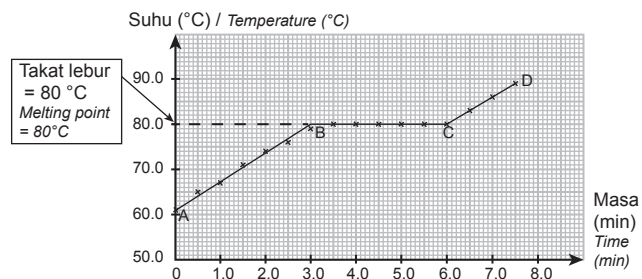
- Zarah disusun secara padat tetapi tidak teratur
Particles are closely packed but not in an orderly manner
- Zarah boleh bergerak bebas
Particles can move freely
- Tenaga kinetik adalah lebih tinggi daripada pepejal
Kinetic energy is higher than solid
- Daya tarikan antara zarah kurang kuat berbanding dengan pepejal
Attraction forces between particles are less strong than solid

Gas / *Gas*



- Zarah berjauhan antara satu sama lain
Particles are far apart
- Zarah boleh bergerak bebas dan rawak
Particles can move freely and randomly
- Tenaga kinetik adalah sangat tinggi
Kinetic energy is very high
- Daya tarikan antara zarah lemah
Low attraction forces between particles

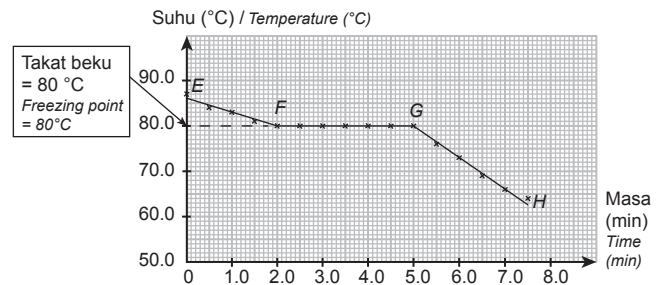
- Graf pemanasan naftalena
Graph for heating of naphthalene



Peringkat Stage	Penerangan Explanation
A	<ul style="list-style-type: none"> Naftalena dalam bentuk pepejal. <i>Naphthalene is in the solid form.</i>
A ke B A to B	<ul style="list-style-type: none"> Suhu <u>meningkat</u>. <i>The temperature is <u>increasing</u>.</i> Tenaga haba yang <u>diserap</u> oleh zarah menyebabkan zarah bergetar dengan lebih <u>cepat</u>. Maka, tenaga kinetik zarah dalam pepejal menjadi lebih <u>tinggi</u>. <i>The heat energy <u>absorbed</u> by the particles causing the particles to vibrate <u>faster</u>. Thus, the kinetic energy of the particles in the solid becomes <u>higher</u>.</i>
B	<ul style="list-style-type: none"> Naftalena mula <u>melebur</u> pada suhu 80 °C. <i>Naphthalene begins to <u>melt</u> at 80 °C.</i> Maka, takat <u>lebur</u> bagi naftalena ialah 80 °C. <i>Therefore, <u>melting</u> point of naphthalene is 80 °C.</i>
B ke C B to C	<ul style="list-style-type: none"> Suhu malar. Keadaan jirim ialah campuran pepejal dan cecair. <i>Constant temperature. The state of matter is a mixture of solid and liquid.</i> Tenaga haba <u>diserap</u> oleh zarah-zarah dalam pepejal dan digunakan untuk mengatasi daya tarikan antara zarah. Maka pepejal naftalena berubah menjadi cecair. <i>Heat energy <u>absorbed</u> by the particles in the solid and is used to overcome the attraction forces between the particles. Thus, the naphthalene solid turns into a liquid.</i>
C	<ul style="list-style-type: none"> Naftalena telah selesai <u>melebur</u>. <i>Naphthalene has completely <u>melted</u>.</i>

C ke D C to D	<ul style="list-style-type: none"> Suhu <u>meningkat</u>. <i>The temperature is <u>increasing</u>.</i> Tenaga haba <u>diserap</u> oleh zarah menyebabkan zarah bergetar dengan lebih <u>cepat</u>. Maka, tenaga kinetik zarah dalam cecair menjadi lebih <u>tinggi</u>. <i>The heat energy <u>absorbed</u> by the particles causing the particles to vibrate <u>faster</u>. Thus, the kinetic energy of the particles in the liquid becomes <u>higher</u>.</i>
D	<ul style="list-style-type: none"> Pemanasan dihentikan. <i>Heating is stopped.</i>

(ii) Graf penyejukan naftalena
Graph for cooling of naphthalene



Peringkat Stage	Penerangan Explanation
E	<ul style="list-style-type: none"> Naftalena dalam bentuk cecair. <i>Naphthalene is in the liquid form.</i>
E ke F E to E	<ul style="list-style-type: none"> Suhu <u>menurun</u>. <i>The temperature is <u>decreasing</u>.</i>
	<ul style="list-style-type: none"> Tenaga haba <u>dibebaskan</u> ke persekitaran oleh zarah menyebabkan zarah bergerak dengan semakin <u>perlahan</u>. Maka, tenaga kinetik zarah dalam pepejal menjadi lebih <u>rendah</u>. <i>The heat energy is <u>released</u> to the surroundings by the particles causing the particles to move <u>slower</u>. Thus, the kinetic energy of the particles in the liquid becomes <u>lower</u>.</i>

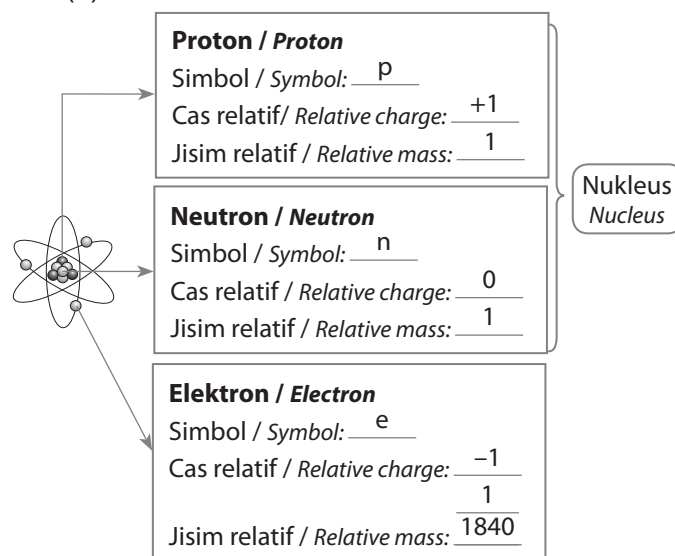
F	<ul style="list-style-type: none"> Naftalena mula <u>membeku</u> pada suhu 80 °C. <i>Naphthalene begins to <u>freeze</u> at 80 °C.</i> Maka, takat <u>beku</u> bagi naftalena ialah 80 °C. <i>Therefore, <u>freezing</u> point of naphthalene is 80 °C.</i>
F ke G F to G	<ul style="list-style-type: none"> Suhu malar. Keadaan jirim ialah campuran cecair dan pepejal. <i>Constant temperature. The state of matter is a mixture of liquid and solid.</i> Tenaga haba <u>dibebaskan</u> ke persekitaran oleh zarah-zarah dalam cecair naftalena dan diimbangi oleh tenaga haba yang terbebas. Zarah cecair tertarik antara satu sama lain dan membentuk pepejal. Maka, cecair naftalena berubah menjadi pepejal. <i>The heat energy is <u>released</u> to the surroundings by the particles in the liquid naphthalene and is balanced by the heat. The liquid particles are attracted to each other and form a solid. Thus, the liquid naphthalene turns into a solid.</i>
G	<ul style="list-style-type: none"> Naftalena telah selesai <u>membeku</u>. <i>Naphthalene has completely <u>frozen</u>.</i>
G ke H G to H	<ul style="list-style-type: none"> Suhu <u>menurun</u>. <i>The temperature is <u>decreasing</u>.</i> Tenaga haba yang <u>dibebaskan</u> oleh zarah menyebabkan zarah bergerak dengan lebih <u>perlahan</u> dan akhirnya bergetar pada kedudukan yang tetap. Maka, tenaga kinetik zarah dalam cecair menjadi lebih rendah. <i>The heat energy is <u>released</u> by the particles causing the particles to move <u>slower</u> and finally vibrate at a fixed position. Thus, the kinetic energy of the particles in the liquid becomes <u>lower</u>.</i>
H	<ul style="list-style-type: none"> Penyejukan dihentikan. <i>Cooling is stopped.</i>

- (b) Naftalena mudah terbakar.
Naphthalene is flammable.
- (c) (i) proses pemanasan lebih sekata, 100 °C
an even heating process, 100 °C
- (ii) dikacau
stirred

2.2 Perkembangan Model Atom The Development of the Atomic Model

1. (a) halus, diskrit
tiny, discrete

(b)



2. (a) Model Atom Dalton
Dalton's Atomic Model
- atom
atoms
 - sfera, dicipta, dimusnahkan, dibahagi
spheres, created, destroyed, divided
- (b) Model Atom Thomson
Thomson's Atomic Model
- elektron
electrons
 - positif, elektron
positively, electrons
- (c) Model Atom Rutherford
Rutherford's Atomic Model
- nukleus
nucleus
 - Nukleus, positif, proton
Nucleus, positively, protons
- (d) Model Atom Bohr / Bohr's Atomic Model
- petala / shells
shells
 - Elektron, nukleus / Electrons, nucleus
- (e) Model Atom Chadwick / Chadwick's Atomic Model
- neutron / neutrons

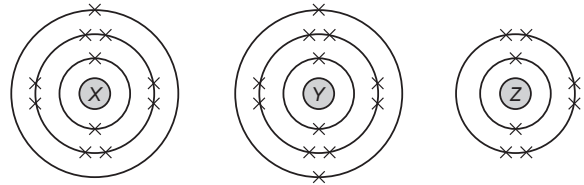
2.3 Struktur Atom
Atomic Structure

- Nombor nucleon
Nucleon number
 - Nombor proton
Proton number
 - Simbol unsur
Symbol of the element
- bilangan proton; neutron
number of protons; neutrons
 - bilangan proton
number of protons
 - (i) 23
(ii) 11
- Proton, elektron dan neutron
Proton, electron and neutron
 - $Q = 12, R = 18$
 - 3
-

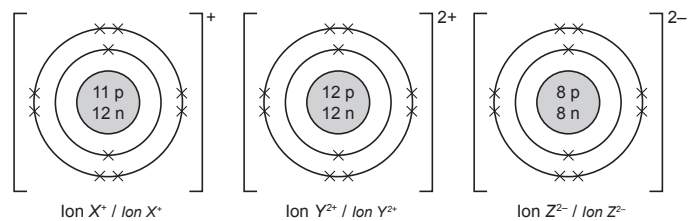
Perwakilan piawai atom <i>Standard representation of atom</i>	Rajah struktur atom <i>Diagram of atomic structure</i>	Rajah susunan elektron <i>Diagram of electron arrangement</i>
(a) ${}_{19}^{39}\text{K}$		
(b) ${}_{12}^{24}\text{Mg}$		
(c) ${}_{16}^{32}\text{S}$		
(d) ${}_{9}^{19}\text{F}$		

- (i) Nombor nukleon / *Nucleon number*
(ii) ${}_{12}^{24}\text{Y}$
 - X kerana bilangan proton melebihi bilangan elektron.
X because the number of protons exceeds the number of electrons.

(c)



(d)



2.4 Isotop dan Penggunaannya
Isotopes and Their Uses

- Sama / *Same*
 - Sama / *Same*
 - Sama / *Same*
- 12, 12, 12
 - 12, 13, 12
 - 12, 14, 12
 - 8, 8, 8
- Kelimpahan semula jadi ialah peratusan isotop yang wujud dalam suatu sampel semula jadi unsur itu.
Natural abundance is the percentage of isotopes present in a natural sample of the element.

$$(b) \frac{(75 \times 35) + (25 \times 37)}{100} = 35.5$$

- Klorin-35 / *Chlorine-35*: 18 neutron / *neutrons*
Klorin-37 / *Chlorine-37*: 20 neutron / *neutrons*

- Andaikan kelimpahan semula jadi iridium-191 ialah x dan iridium-193 ialah $(100 - x)$.
Assume the natural abundance of iridium-191 is x and that of iridium-193 is $(100 - x)$.

$$\frac{(x \times 191) + [(100 - x) \times 193]}{100} = 192.22$$

$$19300 - 2x = 19222$$

$$x = 39$$

Iridium-191 / *Iridium-191* = 39%

Iridium-193 / *Iridium-191* = 61%

$$(e) \frac{(69 \times 63) + (31 \times y)}{100} = 63.62$$

$$4347 + 31y = 6362$$

$$y = 65$$

4. (a) Alat pengesan untuk mengkaji kumbahan dan bahan buangan cecair
Detector to study sewage and liquid waste
- (b) Karbon-14
Carbon-14
- (c) Mengkaji metabolisme tumbuhan
Study of plants metabolism
- (d) Uranium-235
Uranium-235
- (e) Iodin-131
Iodine-131
- (f) Mensterilkan alat pembedahan
Sterilising surgical tools
- (g) Mengesan kebocoran paip bawah tanah
Detecting leakage in underground pipes
- (h) Plumbum-210
Lead-210
- (i) Kobalt-60
Cobalt-60



KBAT EKSTRA BAB 2

1. (a) • Fosforus-32
Phosphorus-32
- Nitrogen-15
Nitrogen-15
2. (b) Setuju, kerana isotop membantu merawat pesakit dengan lebih tepat dan cepat.
Agree, because isotopes help to treat patients more accurately and quickly.
- Atau / or
- Tidak setuju, kerana rawatan yang menggunakan bahan radioaktif membahayakan pesakit jika terlalu banyak terdedah kepada bahan tersebut.
Disagree, because the treatments that use radioactive materials are harmful to the patients if overexposed to the materials.

JAWAPAN

PRAKTIS SPM 1

Bab 1 - Bab 2

KERTAS 1

1. B 2. D 3. D 4. B 5. C
6. A 7. C 8. C 9. D 10. C
11. B 12. D 13. A

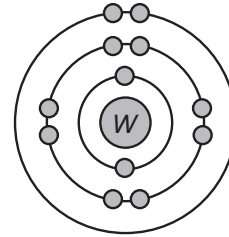
KERTAS 2

Bahagian A

1. (a) • Membangunkan sumber tenaga yang baharu dan memperbaiki yang sedia ada
Developing new sources of energy and improving existing ones
- Memperbaiki produktiviti pertanian melalui penghasilan baja, pestisid dan herbisid untuk meningkatkan hasil pertanian serta melindungi tanaman daripada haiwan perosak dan penyakit
Improving agricultural productivity by developing fertilisers, pesticides and herbicides to increase crop yields and protect crops from pests and diseases
 - Meningkatkan kelestarian alam sekitar dengan membangunkan kaedah untuk membersihkan bahan buangan berbahaya dan mengurangkan pencemaran udara dan air
Improving environmental sustainability by developing methods for cleaning up hazardous waste and reducing air and water pollution
 - Menghasilkan barangan kegunaan harian seperti kosmetik, agen pencuci dan bahan tambah makanan
Producing daily use items, such as cosmetics, cleaning agents and food additives
- (b) (i) Teknologi hijau
Green technology
- (ii) Boleh dibaharui
Renewable
2. (a) Jumlah bilangan proton dan neutron di dalam nukleus sesuatu atom.
Total number of protons and neutrons in the nucleus of an atom.

- (b) (i) 24
(ii) ${}_{12}^{24}\text{X} / {}_{12}^{24}\text{Mg}$
- (c) (i) Bilangan proton / bilangan elektron yang sama
Same number of protons / number of electrons

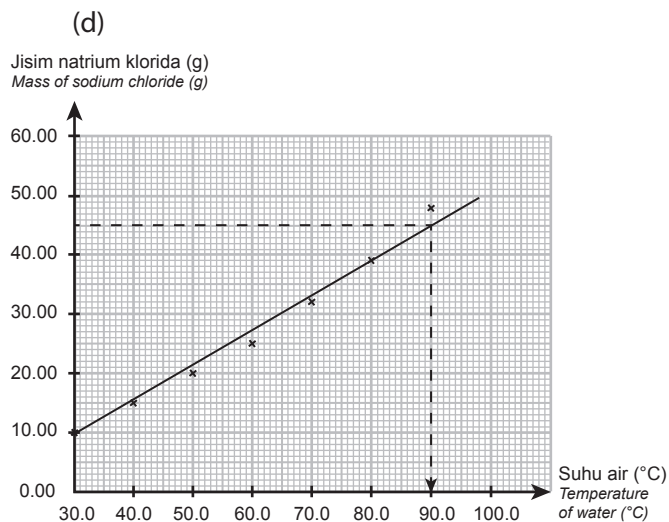
(ii)



- (iii) Digunakan dalam radioterapi untuk membunuh sel kanser tanpa pembedahan / Mensterilkan alat perubatan
Used in radiotherapy to kill cancer cells without surgery / Sterilise surgical tools

Bahagian B

3. (a) Adakah jisim natrium klorida yang larut di dalam air meningkat apabila suhu air meningkat?
Does the mass of sodium chloride dissolved in water increase when temperature of water increases?
- (b) Semakin tinggi suhu air, semakin bertambah jisim natrium klorida yang larut di dalamnya.
The higher the temperature of water, the greater the mass of sodium chloride dissolved in it.
- (c) – Pemboleh ubah dimanipulasikan: Suhu air
Manipulated variable: Temperature of water
- Pemboleh ubah bergerak balas: Jisim natrium klorida yang larut di dalam air
Responding variable: Mass of sodium chloride dissolved in water
- Pemboleh ubah dimalarkan: Isi padu air
Fixed variable: Volume of water



(e) (i) Semakin tinggi suhu air, semakin bertambah jisim natrium klorida yang larut di dalamnya.

The higher the temperature of water, the greater the mass of sodium chloride dissolved in it.

(ii) 90.0 °C

(iii) Jisim natrium klorida yang larut di dalam 250 cm³ air :

Mass of sodium chloride that dissolves in 250 cm³ of water:

$$\frac{250 \text{ cm}^3 \times 25 \text{ g}}{100 \text{ cm}^3} = 62.5 \text{ g}$$

- (f) 1. Mengenal pasti masalah
Identifying the problem
2. Membuat hipotesis
Making a hypothesis
3. Mengenal pasti pemboleh ubah
Identifying variables
4. Mengawal pemboleh ubah
Controlling variables
5. Merancang eksperimen
Planning an experiment
6. Mengumpul data
Collecting data

4. (a) (i) *W* dan *X*
W and X

(ii) 2.8.1

(iii) Isotop ialah atom-atom bagi unsur yang sama yang mempunyai bilangan proton yang sama tetapi bilangan neutron yang berbeza.

Isotopes are atoms of the same element that have the same number of protons but different numbers of neutrons.

Isotop Isotope	Fungsi Function
Kobalt-60 Cobalt-60	Digunakan dalam radioterapi untuk membunuh sel kanser tanpa pembedahan / Mensterilkan alat perubatan atau alat pembedahan <i>Used in radiotherapy to kill cancer cells without surgery / Sterilises medical or surgical instruments.</i>
Iodin-131 Iodine-131	Digunakan dalam rawatan penyakit tiroid seperti kanser tiroid dan hipertiroidisme <i>Used in the treatment of thyroid diseases such as thyroid cancer and hyperthyroidism</i>
Fosforus-32 Phosphorus-32	Mengkaji metabolisme tumbuhan <i>Study plant metabolism</i>

(Mana-mana jawapan yang sesuai / Any suitable answers)

(b) 1. Model Atom Dalton

Dalton's Atomic Model

- Jirim dibentuk oleh atom.

Matter is formed by atoms.

- Atom berbentuk sfera yang sangat kecil, tidak boleh dicipta, dimusnahkan atau dibahagi.

Atoms are very small spheres, cannot be created, destroyed or divided.

- Unsur yang sama mempunyai atom yang sama saiz dan jenis.

The same element has the same atomic size and type.

2. Model Atom Thomson / Thomson's Atomic Model

- Menemui zarah bercas negatif iaitu elektron.

Discovered negatively charged particles which are electrons.

- Atom berbentuk sfera yang bercas positif dengan beberapa elektron di dalamnya.

An atom is a positively charged sphere with a few electrons in it.

3. Model Atom Rutherford

Rutherford's Atomic Model

- Menemui nukleus. / *Discovered nucleus.*

- Terdiri daripada zarah bercas positif yang dipanggil proton dalam nukleus.
Consist of positively charged particle called proton in the nucleus.

- Jisim atom tertumpu di nukleus.

Atomic mass is concentrated in the nucleus.

- Elektron ialah zarah yang bergerak di luar nukleus.
Electrons are particles that move outside the nucleus.
4. Model Atom Bohr
Bohr's Atomic Model
- Menemui petala. / *Discovered shell.*
 - Elektron bergerak di dalam petala mengelilingi nukleus.
Electrons move in the shells around the nucleus.
5. Model Atom Chadwick
Chadwick's Atomic Model
- Menjumpai zarah neutron yang bercas neutral dalam nukleus.
Found neutrons which are neutral particles in the nucleus.
 - Neutron menyumbang hampir separuh daripada jisim sesuatu atom.
Neutrons contribute almost half of the mass of an atom.

Bahagian C

5. (a) (i) Kaedah saintifik ialah kaedah sistematik dalam menyelesaikan masalah berkaitan sains.
Scientific method is a systematic method used to solve problems related to science.
- (ii) Deria penglihatan, pendengaran, sentuhan atau bau digunakan untuk mengumpulkan maklumat tentang objek dan fenomena.
Senses of sight, hearing, touch or smell are used to gather information about an object or a phenomenon.
- (iii) • Pemboleh ubah dimanipulasikan
Manipulated variable
- Pemboleh ubah bergerak balas
Responding variable

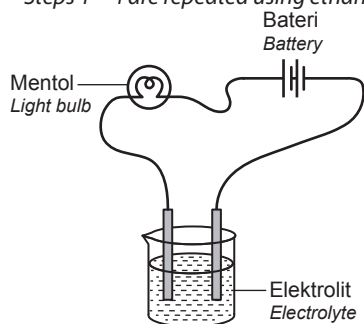
(b)

Alat pelindung diri <i>Personal protective equipment</i>	Fungsi <i>Function</i>
Kaca mata keselamatan <i>Safety goggles</i>	Melindungi tangan daripada tercedera dan terkena bahan kimia. <i>Protect the eyes from chemical splash and dust.</i>

Topeng muka <i>Face mask</i>	Melindungi organ pernafasan daripada terkena bahan kimia seperti serbuk atau wasap. <i>Protects the respiratory organs from chemicals such as powders or fumes.</i>
Sarung tangan <i>Gloves</i>	Melindungi tangan daripada tercedera dan terkena bahan kimia. <i>Protect the hands from injuries and chemicals.</i>
Baju makmal <i>Laboratory coat</i>	Melindungi badan dan pakaian daripada tumpahan bahan kimia. <i>Protects the body and clothes from chemical spills.</i>
Kasut makmal <i>Laboratory shoes</i>	Melindungi kaki daripada tumpahan bahan kimia, bahan toksik atau benda tajam. <i>Protect the feet from chemical spills, toxic substances or sharp objects.</i>

- (c) Bahan: Larutan natrium klorida dan etanol
Materials: Sodium chloride solution and ethanol
- Radas: Dua bikar 100 ml, dua elektrod karbon, mentol, dua sel kering dan wayar penyambung.
Apparatus: Two 100 ml beakers, two carbon electrodes, light bulb, two dry cells and connecting wires.
- Pemboleh ubah dimanipulasikan: Elektrolit
Manipulated variable: Electrolyte
- Pemboleh ubah bergerak balas: Mentol menyala
Responding variable: Light bulb lights up
- Pemboleh ubah dimalarkan: Bilangan sel kering
Fixed variable: Number of dry cells
- Prosedur / *Procedure:*
1. 50 cm³ larutan natrium klorida dituang ke dalam beaker 100 ml.
50 cm³ of sodium chloride solution is pour into a 100 ml beaker.
 2. Dua karbon elektrod direndam ke dalam larutan.
Two carbon electrodes are immersed into the solution.
 3. Elektrod disambungkan pada mentol dan dua sel kering.
The electrodes are connected to a light bulb and two dry cells.
 4. Mentol diperhatikan dan pemerhatian direkodkan dalam jadual.
The light bulb is observed and the observations obtained are recorded in a table.

5. Langkah 1 – 4 diulangi dengan menggunakan etanol.
Steps 1 – 4 are repeated using ethanol.



Keputusan / Result

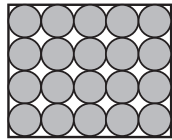
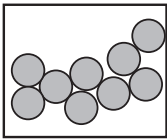
Bahan Substance	Larutan natrium klorida Sodium chloride solution	Etanol Ethanol
Pemerhatian Observation	Mentol menyala. Light bulb lights up.	Mentol tidak menyala. Light bulb does not light up.
Inferens Inferences	Larutan natrium klorida boleh menghantarkan elektrik. Sodium chloride solution can conduct electricity.	Etanol tidak boleh menghantarkan elektrik. Ethanol cannot conduct electricity.

Kesimpulan / Conclusion:

Larutan akueus garam boleh menghantarkan elektrik, manakala pelarut organik tidak boleh menghantarkan elektrik.

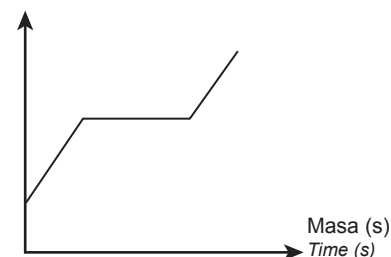
An aqueous salt solution conducts electricity, whereas an organic solvent does not conduct electricity.

6. (a) (i)

	Ais / Ice	Air / Water
Rajah susunan zarah Diagram of particle arrangement		
Susunan zarah Particle arrangement	Zarah disusun secara padat dan teratur. Particles are closely packed in an orderly manner.	Zarah disusun secara padat tetapi tidak teratur. Particles are closely packed but not in an orderly manner.

Pergerakan zarah Particle movement	Zarah hanya bergetar pada kedudukan yang tetap. Particles only vibrate at a fixed position.	Zarah boleh bergerak bebas. Particles can move freely.
Tenaga kinetik Kinetic energy	Tenaga kinetik adalah rendah. Kinetic energy is low.	Tenaga kinetik adalah tinggi. Kinetic energy is high.

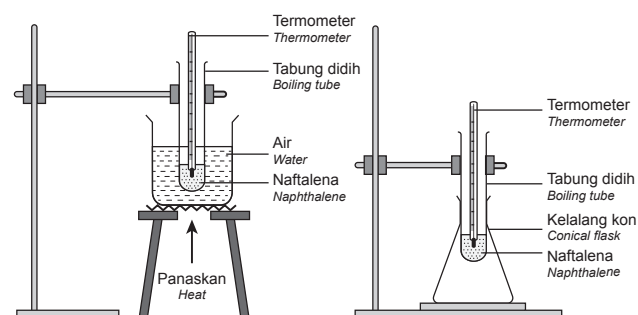
- (ii) Suhu (°C) / Temperature (°C)



- (b) Bahan: Naftalena, C₁₀H₈ dan air
Material: Naphthalene, C₁₀H₈ and water

Radas: Tabung didih, bikar 250 cm³, termometer, tungku kaki tiga, kaki retort dan pengapit, penunu Bunsen, jam randik, kelalang kon, kasa dawai dan spatula

Apparatus: Boiling tube, 250 cm³ beaker, thermometer, tripod stand, retort stand with clamp, Bunsen burner, stopwatch, conical flask, wire gauze and spatula



Prosedur / Procedure:

- Satu per tiga tabung didih diisi dengan naftalena.
One third of a boiling tube is filled with naphthalene.
- Termometer diletakkan ke dalam tabung didih berisi naftalena.
Thermometer is put into boiling tube filled with naphthalene.

3. Air diisi ke dalam bikar sehingga separuh penuh.

Water is poured into a beaker until it is half filled.

4. Tabung didih dimasukkan ke dalam bikar yang berisi air dan tabung didih diapitkan pada kaki retort. Paras air perlu berada lebih tinggi daripada aras naftalena di dalam tabung didih.

Boiling tube is immersed in the beaker filled with water and the boiling tube is clamped on a retort stand. The level of water must be higher than the level of naphthalene in the boiling tube.

5. Pemanasan dimulakan dan naftalena, $C_{10}H_8$ perlu sentiasa dikacau secara perlahan dengan menggunakan termometer. Apabila suhu mencapai $60\text{ }^{\circ}\text{C}$, jam randik dimulakan.

Heating is started and naphthalene, $C_{10}H_8$ should always be stirred slowly using a thermometer. When the temperature reaches $60\text{ }^{\circ}\text{C}$, the stopwatch is started.

6. Suhu dan keadaan jirim dicatatkan pada sela masa 30 saat di dalam jadual yang disediakan sehingga suhu mencapai $90\text{ }^{\circ}\text{C}$.

The temperature and the state of matter are recorded at 30 seconds intervals until the temperature reaches $90\text{ }^{\circ}\text{C}$.

7. Tabung didih dikeluarkan dan daripada bikar. Tabung didih dikeringkan menggunakan kain yang kering dan dengan cermat dimasukkan ke dalam kelalang kon utk menjalani proses penyejukan.

The boiling tube is removed from the beaker. The boiling tube is dried using a dry cloth and carefully placed in a conical flask to undergo the cooling process.

8. Naftalena sentiasa dikacau menggunakan termometer.

Naphthalene is always stirred using a thermometer.

9. Suhu dan keadaan jirim semasa penyejukan naftalena direkodkan pada sela 30 saat sehingga suhu mencapai $60\text{ }^{\circ}\text{C}$.

The temperature and the state of matter during cooling of naphthalene are recorded at 30 seconds intervals until the temperature reaches $60\text{ }^{\circ}\text{C}$.

10. Pemerhatian dan suhu direkodkan dalam jadual.

Observations and temperatures are recorded in the table.

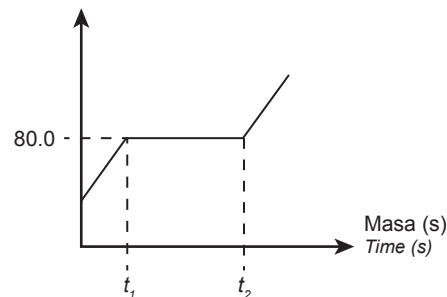
Keputusan / Result:

Masa (s) Time (s)	Suhu ($^{\circ}\text{C}$) Temperature ($^{\circ}\text{C}$)	Keadaan jirim State of matter
10		
30		
60		
90		
120		
150		
180		
210		
240		

Lengkung graf pemanasan naftalena:

Heating curve of naphthalene:

Suhu ($^{\circ}\text{C}$) / Temperature ($^{\circ}\text{C}$)



Kesimpulan / Conclusion:

Takat lebur naftalene ialah $80\text{ }^{\circ}\text{C}$.

Melting point of naphthalene is $80\text{ }^{\circ}\text{C}$.

JAWAPAN

BAB 3

3.1 Jisim Atom Relatif dan Jisim Molekul Relatif Relative Atomic Mass and Relative Molecular Mass

1. (a) Jisim atom relatif
Relative atomic mass
- (b) Jisim molekul relatif
Relative molecular mass

2. Bilangan atom aluminium
Number of aluminium atoms

$$= \frac{108}{27} = 4$$

3. pepejal / solid
12.0, 99%

4.

	Natrium <i>Sodium</i> Na = 23	Magnesium <i>Magnesium</i> Mg = 24	Aluminium <i>Aluminium</i> Al = 27	Plumbum <i>Lead</i> Pb = 207	Nitrogen <i>Nitrogen</i> N = 14	Hidrogen <i>Hydrogen</i> H = 1
Klorin <i>Chlorine</i> Cl = 35.5	NaCl	MgCl ₂	AlCl ₃	PbCl ₄	NH ₄ Cl	
JFR / RFM	58.5	95	133.5	349	53.5	
Nitrogen <i>Nitrogen</i> N = 14	NaNO ₃	Mg(NO ₃) ₂	Al(NO ₃) ₃	Pb(NO ₃) ₄	NH ₄ NO ₃	
Oksigen <i>Oxygen</i> O = 16						
JFR / RFM	85	148	213	455	80	
Oksigen <i>Oxygen</i> O = 16	Na ₂ O	MgO	Al ₂ O ₃	PbO ₂	(NH ₄) ₂ O	
JFR / RFM	62	40	102	239	52	
Sulfur <i>Sulphur</i> S = 32	Na ₂ SO ₄	MgSO ₄	Al ₂ (SO ₄) ₃	Pb(SO ₄) ₂	(NH ₄) ₂ SO ₄	
Oksigen <i>Oxygen</i> O = 16						
JFR / RFM	142	120	342	399	132	
Fosforus <i>Phosphorus</i> P = 31	Na ₃ PO ₄	Mg ₃ (PO ₄) ₂	AlPO ₄	Pb ₃ (PO ₄) ₄	(NH ₄) ₃ PO ₄	
Oksigen <i>Oxygen</i> O = 16						
JFR / RFM	164	262	122	1001	149	

3.2 Konsep Mol
Mole Concept

1.	Definisi / Definition	Istilah / Term
(a)	Kuantiti suatu bahan. <i>Amount of substance.</i>	Jisim molar <i>Molar mass</i>
(b)	Jisim bagi satu mol bahan. <i>The mass of one mole of substance.</i>	Nombor Avogadro <i>Avogadro's number</i>
(c)	Isi padu yang ditempati oleh satu mol gas. <i>The volume occupied by one mole of a gas.</i>	Mol <i>Mole</i>
(d)	Bilangan zarah yang terkandung dalam satu mol bahan. <i>The number of particles in one mole substance.</i>	Isi padu molar <i>Molar volume</i>

2. (b) $\frac{3.6125 \times 10^{22}}{6.02 \times 10^{23}} = 0.06 \text{ mol}$

(c) $\frac{2.408 \times 10^{22}}{6.02 \times 10^{23}} = 0.04 \text{ mol}$

(d) $\frac{7.224 \times 10^{23}}{6.02 \times 10^{23}} = 1.2 \text{ mol}$

3. (a) $0.5 \times 6.02 \times 10^{23}$
 $= 3.01 \times 10^{23}$

(b) $0.3 \times 6.02 \times 10^{23}$
 $= 1.806 \times 10^{23}$

(c) $1.25 \times 3 \times 6.02 \times 10^{23}$
 $= 2.2575 \times 10^{24}$

(d) $0.7 \times 4 \times 6.02 \times 10^{23}$
 $= 1.6856 \times 10^{24}$

$0.7 \times 6.02 \times 10^{23}$
 $= 4.214 \times 10^{23}$

(e) $0.08 \times 2 \times 6.02 \times 10^{23}$
 $= 9.632 \times 10^{22}$

$0.08 \times 6.02 \times 10^{23}$
 $= 4.816 \times 10^{22}$

4.	Bahan / Substance	JMR / RMM				
	CuCO ₃	124	Jisim (g) / Mass (g)	8.68	10.85	27.125
			Bilangan mol (mol) Number of moles (mol)	0.07	0.088	0.22
	MgO	40	Jisim (g) / Mass (g)	2.4	7.2	3.672
			Bilangan mol (mol) Number of moles (mol)	0.06	0.18	0.09
	NaNO ₃	85	Jisim (g) / Mass (g)	10.2	19.55	33.15
			Bilangan mol (mol) Number of moles (mol)	0.12	0.23	0.39
	FeCl ₃	162.5	Jisim (g) / Mass (g)	73.125	86.125	45.5
			Bilangan mol (mol) Number of moles (mol)	0.45	0.53	0.28
	NO ₂	46	Jisim (g) / Mass (g)	5.52	15.18	32.66
			Bilangan mol (mol) Number of moles (mol)	0.12	0.33	0.71
	HOCl	52.5	Jisim (g) / Mass (g)	26.25	1.05	12.6
			Bilangan mol (mol) Number of moles (mol)	0.50	0.02	0.24

Na ₂ SO ₄	142	Jisim (g) / Mass (g)	24.14	32.66	76.68
		Bilangan mol (mol) Number of moles (mol)	0.17	0.23	0.54
Cu(NO ₃) ₂	188	Jisim (g) / Mass (g)	20.68	189.88	141.00
		Bilangan mol (mol) Number of moles (mol)	0.11	1.01	0.75

5. (a) $\frac{480}{24}$
= 20 mol
- (b) 3 mol H₂ = 2 mol NH₃
30 mol H₂ = 20 mol NH₃
30 mol H₂ diperlukan untuk menghasilkan
20 mol NH₃
30 mol of H₂ needed to produce 20 mol NH₃
Isi padu gas hidrogen
Volume of hydrogen gas
= 30 × 24 = 720 dm³

6. (a)


Unsur Element	Karbon, C Carbon, C	Hidrogen, H Hydrogen, H	Oksigen, O Oxygen, O
Jisim (%) Mass (%)	52.17	13.05	34.78
Bilangan mol Number of moles	$\frac{52.17}{12} = 4.348$	$\frac{13.05}{1} = 13.05$	$\frac{34.78}{16} = 2.174$
Nisbah mol Mole ratio	$\frac{4.348}{2.174} = 2$	$\frac{13.05}{2.174} = 6$	$\frac{2.174}{2.174} = 1$
Formula empirik Empirical formula	C ₂ H ₆ O		

- (b) Anggapkan formula molekul sebatian X
Assume that molecular formula of compound W =
(C₂H₆O)_n
(C₂H₆O)_n = 138
[2(12) + 6(1) + 16]n = 138
46n = 138
n = 3
Maka, formula molekul sebatian X
Hence, the molecular formula of compound X =
(C₂H₆O)₃ = C₆H₁₈O₃

3.3 Formula Kimia Chemical Formula

- (a) huruf, subskrip / letters, subscripts
(b) teringkas / simplest
(c) sebenar / actual
-

Formula molekul Molecular formula	Formula empirik Empirical formula
(a) Glukosa, C ₆ H ₁₂ O ₆ Glucose, C ₆ H ₁₂ O ₆	C ₅ H ₄
(b) Naftalena, C ₁₀ H ₈ Naphthalene, C ₁₀ H ₈	C ₄ H ₅ N ₂ O
(c) Fosforus(V) oksida, P ₄ O ₁₀ Phosphorus(V) oxide, P ₄ O ₁₀	CH ₂ O
(d) Asid askorbik, C ₆ H ₈ O ₆ Ascorbic acid, C ₆ H ₈ O ₆	NH ₃
(e) Kafein, C ₈ H ₁₀ N ₄ O ₂ Caffeine, C ₈ H ₁₀ N ₄ O ₂	P ₂ O ₅
(f) Gas ammonia, NH ₃ Ammonia gas, NH ₃	C ₃ H ₄ O ₃



3. Mentafsir data Interpreting data:

Unsur Element	Magnesium, Mg Magnesium, Mg	Oksigen, O Oxygen, O
Jisim unsur (g) Mass of element (g)	256.29 – 250.05 = 6.24	260.45 – 256.29 = 4.16
Bilangan mol Number of moles	$\frac{6.24}{24} = 0.26$	$\frac{4.16}{16} = 0.26$
Nisbah mol teringkas Simplest moles ratio	1	1

Perbincangan / Discussion:

- (a) reaktif, magnesium oksida
reactive, magnesium oxide
- (b) kertas pasir, lapisan oksida / *sandpaper, oxide layer*
- (c) oksigen, magnesium / *oxygen, magnesium*
- (d) magnesium oksida / *magnesium oxide*

Kesimpulan / Conclusion

- (e) MgO / *MgO*

4. Mentafsir data / Interpreting data:

Unsur Element	Kuprum, Cu <i>Copper, Cu</i>	Oksigen, O <i>Oxygen, O</i>
Jisim unsur (g) Mass of element (g)	5.54 – 4.90 = 0.64	5.70 – 5.54 = 0.16
Bilangan mol Number of moles	$\frac{0.64}{64} = 0.01$	$\frac{0.16}{16} = 0.01$
Nisbah mol terringkas Simplest moles ratio	1	1

Perbincangan / Discussion

- (a) hitam, hidrogen, perang
black, hydrogen, brown
- (b) hidrogen, kuprum, oksigen, kuprum(II) oksida
hydrogen, copper, oxygen, copper(II) oxide
- (c) pemanasan, penyejukan, kuprum(II) oksida, hidrogen, kuprum
heating, cooling, copper(II) oxide, hydrogen, copper

Kesimpulan / Conclusion

- (d) CuO / *CuO*

5.

Unsur Element	Kalsium, Ca <i>Calcium, Ca</i>	Karbon, C <i>Carbon, C</i>	Oksigen, O <i>Oxygen, O</i>
Jisim (%) Mass (%)	40	12	48
Bilangan mol atom Number of moles of atom	$\frac{40}{40} = 1$	$\frac{12}{12} = 1$	$\frac{48}{16} = 3$
Nisbah mol Mole ratio	1	1	3
Formula empirik Empirical formula	CaCO ₃		

6.

Unsur / Element	M	Oksigen, O <i>Oxygen, O</i>
Jisim (g) / Mass (g)	5.4	x

Bilangan mol atom Number of moles of atom	$\frac{5.4}{27} = 0.2$	$\frac{x}{16}$
Nisbah mol Mole ratio	2	3

$$\frac{x}{16} \times 2 = 0.2 \times 3$$

$$\frac{2x}{16} = 0.6$$

$$2x = 9.6$$

$$x = 4.8$$

7. (a)

Unsur Element	Karbon, C <i>Carbon, C</i>	Hidrogen, H <i>Hydrogen, H</i>	Oksigen, O <i>Oxygen, O</i>
Jisim (%) Mass (%)	26.7	2.2	71.7
Bilangan mol atom Number of moles of atom	$\frac{26.7}{12} = 2.23$	$\frac{2.2}{1} = 2.2$	$\frac{71.7}{16} = 4.481$
Nisbah mol Mole ratio	$\frac{2.23}{2.2} = 1$	$\frac{2.2}{2.2} = 1$	$\frac{4.48}{2.2} = 2$
Formula empirik Empirical formula	CHO ₂		

- (b) Anggapkan formula molekul sebatian

$$W = (\text{CHO}_2)_n$$

Assume that the molecular formula of compound

$$W = (\text{CHO}_2)_n$$

$$(\text{CHO}_2)_n = 90$$

$$[12 + 1 + 2(16)]n = 90$$

$$45n = 90$$

$$n = 2$$

Maka, formula molekul sebatian W

Hence, the molecular formula of compound W

$$(\text{CHO}_2)_2 = \text{C}_2\text{H}_2\text{O}_4$$

8.

Kation / Cation	Formula kation / Formula of cation
(a) Ion hidrogen <i>Hydrogen ion</i>	H ⁺
(b) Ion litium <i>Lithium ion</i>	Li ⁺
(c) Ion natrium <i>Sodium ion</i>	Na ⁺
(d) Ion kalium <i>Potassium ion</i>	K ⁺
(e) Ion argentum <i>Silver ion</i>	Ag ⁺

(f) Ion ammonium <i>Ammonium ion</i>	NH_4^+
(g) Ion magnesium <i>Magnesium ion</i>	Mg^{2+}
(h) Ion zink <i>Zinc ion</i>	Zn^{2+}
(i) Ion kalsium <i>Calcium ion</i>	Ca^{2+}
(j) Ion plumbum(II) <i>Lead(II) ion</i>	Pb^{2+}
(k) Ion kuprum(II) <i>Copper(II) ion</i>	Cu^{2+}
(l) Ion ferum(II) <i>Iron(II) ion</i>	Fe^{2+}
(m) Ion ferum(III) <i>Iron(III) ion</i>	Fe^{3+}
(n) Ion mangan(II) <i>Manganese(II) ion</i>	Mn^{2+}
(o) Ion aluminium <i>Aluminium ion</i>	Al^{3+}
(p) Ion kromium(III) <i>Chromium(III) ion</i>	Cr^{3+}

Anion <i>Anion</i>	Formula anion <i>Formula of anion</i>
(a) Ion hidroksida <i>Hydroxide ion</i>	OH^-
(b) Ion klorida <i>Chloride ion</i>	Cl^-
(c) Ion bromida <i>Bromide ion</i>	Br^-
(d) Ion iodida <i>Iodide ion</i>	I^-
(e) Ion manganat(VII) <i>Manganate(VII) ion</i>	MnO_4^-
(f) Ion nitrat <i>Nitrate ion</i>	NO_3^-
(g) Ion etanoat <i>Ethanoate ion</i>	CH_3COO^-
(h) Ion sulfat <i>Sulphate ion</i>	SO_4^{2-}
(i) Ion karbonat <i>Carbonate ion</i>	CO_3^{2-}
(j) Ion tiosulfat <i>Thiosulphate ion</i>	$\text{S}_2\text{O}_3^{2-}$
(k) Ion kromat(VI) <i>Chromate(VI) ion</i>	CrO_4^{2-}
(l) Ion dikromat(VI) <i>Dichromate(VI) ion</i>	$\text{Cr}_2\text{O}_7^{2-}$
(m) Ion nitride <i>Nitride ion</i>	N^{3-}
(n) Ion fosfat <i>Phosphate ion</i>	PO_4^{3-}

9.

Sebatian ion <i>Ionic compound</i>	Formula kimia <i>Chemical formula</i>
(a) Magnesium sulfat <i>Magnesium sulphate</i>	MgSO_4
(b) Zink nitrat <i>Zinc nitrate</i>	$\text{Zn}(\text{NO}_3)_2$
(c) Kalium oksida <i>Potassium oxide</i>	K_2O
(d) Kuprum(II) sulfat <i>Copper(II) sulphate</i>	CuSO_4
(e) Kalsium karbonat <i>Calcium carbonate</i>	CaCO_3
(f) Argentum nitrat <i>Silver nitrate</i>	AgNO_3
(g) Natrium hidroksida <i>Sodium hydroxide</i>	NaOH
(h) Kalium klorida <i>Potassium chloride</i>	KCl
(i) Ferum(II) sulfat <i>Iron(II) sulphate</i>	FeSO_4
(j) Plumbum(II) iodida <i>Lead(II) iodide</i>	PbI_2
(k) Litium hidroksida <i>Lithium hydroxide</i>	LiOH
(l) Barium nitrat <i>Barium nitrate</i>	$\text{Ba}(\text{NO}_3)_2$
(m) Ammonium fosfat <i>Ammonium phosphate</i>	$(\text{NH}_4)_3\text{PO}_4$
(n) Aluminium nitrat <i>Aluminium nitrate</i>	$\text{Al}(\text{NO}_3)_3$

10.

Sebatian molekul <i>Molecular compound</i>	Formula kimia <i>Chemical formula</i>
(a) Air <i>Water</i>	H_2O
(b) Ammonia <i>Ammonia</i>	NH_3
(c) Karbon dioksida <i>Carbon dioxide</i>	CO_2
(d) Hidrogen klorida <i>Hydrogen chloride</i>	HCl
(e) Sulfur dioksida <i>Sulphur dioxide</i>	SO_2
(f) Nitrogen dioksida <i>Nitrogen dioxide</i>	NO_2
(g) Gas oksigen <i>Oxygen gas</i>	O_2
(h) Gas hidrogen <i>Hydrogen gas</i>	H_2

11.

Sebatian ion <i>Ionic compound</i>	Nama <i>Name</i>
(a) NaCl	Natrium klorida / <i>Sodium chloride</i>
(b) KBr	Kalium bromida / <i>Potassium bromide</i>
(c) AlCl ₃	Aluminium klorida / <i>Aluminium chloride</i>
(d) NH ₄ NO ₃	Ammonium nitrat / <i>Ammonium nitrate</i>
(e) Ca(OH) ₂	Kalsium hidroksida / <i>Calcium hydroxide</i>
(f) MgCO ₃	Magnesium karbonat <i>Magnesium carbonate</i>
(g) ZnSO ₄	Zink sulfat / <i>Zinc sulphate</i>
(h) AgI	Argentum iodida / <i>Silver iodide</i>

Sebatian molekul <i>Molecular compound</i>	Nama <i>Name</i>
(a) CO	Karbon monoksida <i>Carbon monoxide</i>
(b) SO ₃	Sulfur trioksida <i>Sulphur trioxide</i>
(c) S ₂ Cl ₂	Disulfur diklorida <i>Disulphur dichloride</i>
(d) CCl ₄	Karbon tetraklorida <i>Carbon tetrachloride</i>
(e) H ₂ O	Dihidrogen monoksida <i>Dihydrogen monoxide</i>
(f) NO	Nitrogen monoksida <i>Nitrogen monoxide</i>
(g) BCl ₃	Boron triklorida <i>Boron trichloride</i>
(h) N ₂ O ₃	Dinitrogen trioksida <i>Dinitrogen trioxide</i>

3.4 Persamaan Kimia *Chemical Equation*

- $2\text{Fe} + 3\text{Cl}_2 \rightarrow 2\text{FeCl}_3$
 - Bilangan mol pepejal perang
Number of moles of brown solid
$$= \frac{325}{162.5} = 2 \text{ mol}$$

2 mol pepejal perang terbentuk daripada 3 mol gas klorin.
2 moles of brown solid is formed from 3 moles of chlorine gas.

Isi padu gas klorin / *Volume of chlorine gas*
 $= 3 \times 24 = 72 \text{ dm}^3$
 - Bilangan mol pepejal perang / *Number of moles of brown solid*
$$= \frac{65}{162.5} = 0.4 \text{ mol}$$

2 mol pepejal perang terbentuk daripada 2 mol ferum.

Maka, 0.4 mol pepejal perang terbentuk daripada 0.4 mol ferum.

2 moles of brown solid formed from 2 moles of iron.

Thus, 0.4 mole of brown solid formed from 0.4 mole of iron.

Jisim ferum / *Mass of iron*

$$= 0.4 \times 56$$

$$= 22.4 \text{ g}$$



KBAT EKSTRA BAB 3

- Bilangan mol ammonia, NH₃
Number of moles of ammonia, NH₃
$$= \frac{1.5}{14 + 3(1)} = 0.088 \text{ mol (berlebihan / in excess)}$$

Bilangan mol oksigen, O₂
Number of moles of oxygen, O₂
$$= \frac{2.75}{2(16)} = 0.086 \text{ mol (terhad / limited)}$$

Nisbah mol / *Mole ratio*
5 mol O₂ : 4 mol NO
0.086 mol O₂ : 0.069 mol NO

Jisim nitrogen monoksida, NO
Mass of nitrogen monoxide, NO
$$= 0.069 \times (14 + 16)$$

$$= 2.07 \text{ g}$$

Nisbah mol / *Mole ratio*
5 mol O₂ : 6 mol H₂O
0.086 mol O₂ : 0.103 mol H₂O

Jisim air, H₂O / *Mass of water, H₂O*
$$= 0.103 \times [2(1) + 16]$$

$$= 1.85 \text{ g}$$
- Bilangan mol kalsium nitrat, Ca(NO₃)₂
Number of moles of calcium nitrate, Ca(NO₃)₂
$$= \frac{820}{40 + 2[14 + 3(16)]} = 5 \text{ mol}$$

Nisbah mol / *Mole ratio*
1 mol Ca(NO₃)₂ : 2 mol NH₄NO₃
5 mol Ca(NO₃)₂ : 10 mol NH₄NO₃

Jisim maksimum ammonium nitrat, NH₄NO₃
Maximum mass of ammonium nitrate, NH₄NO₃
$$= 10 \times [14 + 4(1) + 14 + 3(16)]$$

$$= 800 \text{ g}$$

4.1 Perkembangan Jadual Berkala Unsur The Development of the Periodic Table of Elements

- gas, logam, Antoine Lavoisier
gases, metals, Antoine Lavoisier
 - triad
triad
 - jisim atom, Hukum Oktaf, John Newlands
atomic mass, Law of Octaves, John Newlands
 - isi padu, jisim
volume, mass
 - menegak
vertical
 - nombor proton, Henry Moseley
proton number, Henry Moseley
- Palsu
False
 - Benar
True
 - Palsu
False
 - Benar
True
 - Benar
True

4.2 Susunan Unsur dalam Jadual Berkala Unsur Moden The Arrangement in the Periodic Table of Elements

- Kala: Baris mengufuk dalam Jadual Berkala Unsur
Period: Horizontal rows in the Periodic Table of Elements
Kumpulan: Lajur menegak dalam Jadual Berkala Unsur
Group: Vertical column in the Periodic Table of Elements
 - Tertib menaik nombor proton
Ascending order of proton numbers
 - X: 2.6
Y: 2.8.2
Z: 2.8.8.1
 - 2.8.3
 - Atom W berada di Kumpulan 13 kerana mempunyai tiga elektron valens dan Kala 3 kerana mempunyai tiga petala berisi elektron.

Atom W is in Group 13 because it has three valence electrons and Period 3 because it has three shells filled with electrons.

- Kumpulan 18, Kala 1 / Group 18, Period 1

4.3 Unsur dalam Kumpulan 18 Elements in Group 18

- Gas adi / gas nadir / Noble gas / inert gas
 - Helium / Helium: 2
Neon / Neon: 2.8
Argon / Argon: 2.8.8
 - Atom unsur-unsur Kumpulan 18 telah mencapai susunan elektron duplet atau oktet yang stabil. Atom unsur-unsur Kumpulan 18 tidak perlu menderma, menerima atau berkongsi elektron dengan atom unsur lain.
Atoms of Group 18 elements have achieved stable duplet or octet electron arrangements. They do not need to donate, accept or share electrons with atoms of other elements.
- Bertambah
Increases
 - Bertambah
Increases
 - Bertambah
Increases
 - Bertambah
Increases
 - Bertambah
Increases
- Takat didih argon lebih tinggi daripada neon. Saiz atom argon lebih besar daripada neon. Daya tarikan van der Waals antara atom-atom bertambah. Lebih banyak tenaga haba diperlukan untuk mengatasi daya tarikan antara atom.
The boiling point of argon is higher than that of neon. The atomic size of argon is larger than neon. The van der Waals attraction force between atoms increases. More energy is needed to overcome the attraction force between atoms.
- Argon
Argon
 - Kripton
Krypton
 - Helium
Helium
 - Radon
Radon

- (e) Xenon
Xenon
- (f) Neon
Neon
- (g) Kripton
Krypton
- (h) Xenon
Xenon
- (i) Argon
Argon
- (j) Helium
Helium

4.4 Unsur dalam Kumpulan 1
Elements in Group 1

1. (a) 2.8.1
- (b) Kumpulan 1 kerana mempunyai satu elektron valens dan Kala 3 kerana mempunyai tiga petala berisi elektron.
Group 1 because it has three valence electrons and Period 3 because it has three shells filled with electrons.
- (c) Logam alkali
Alkali metal
- (d) Supaya mencapai susunan elektron oktet yang stabil
To achieve a stable octet electron arrangement
- (d) Takat lebur rendah / takat didih rendah / lembut / kurang tumpat berbanding dengan air / permukaan kelabu berkilat
Low melting / low boiling point / soft / less dense than water / grey shiny surface
- (f) Saiz atom semakin bertambah apabila menuruni kumpulan. Ikatan logam menjadi semakin lemah. Oleh itu, semakin kurang tenaga haba yang diperlukan untuk memutuskan ikatan logam.
Atomic size increases when going down the group. The metallic bond becomes weaker. Therefore, less heat energy is required to break the metallic bond.

2. A. Tindak balas unsur Kumpulan 1 dengan air
Reaction of Group 1 with water

- (a) Litium
Lithium
- (b) Natrium
Sodium
- (c) Kalium
Potassium

B. Tindak balas unsur Kumpulan 1 dengan gas oksigen
Reaction of Group 1 with oxygen gas

- (a) • merah / *red*
• biru / *blue*
- (b) • kuning terang / *bright yellow*
• biru / *blue*
- (c) • ungu kemerahan / *purple-reddish*
• biru / *blue*

C. Tindak balas unsur Kumpulan 1 dengan gas klorin

Reaction of Group 1 with chlorine gas

- (a) merah
red
- (b) kuning terang
bright yellow
- (c) ungu kemerahan
purple-reddish

Perbincangan/ Discussion:

(i)

Litium <i>Lithium</i>	$2\text{Li} + 2\text{H}_2\text{O} \rightarrow 2\text{LiOH} + \text{H}_2$
Natrium <i>Sodium</i>	$2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$
Kalium <i>Potassium</i>	$2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$

(ii)

Litium <i>Lithium</i>	$4\text{Li} + \text{O}_2 \rightarrow 2\text{Li}_2\text{O}$
Natrium <i>Sodium</i>	$4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$
Kalium <i>Potassium</i>	$4\text{K} + \text{O}_2 \rightarrow 2\text{K}_2\text{O}$

(iii)

Litium <i>Lithium</i>	$2\text{Li} + \text{Cl}_2 \rightarrow 2\text{LiCl}$
Natrium <i>Sodium</i>	$2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$
Kalium <i>Potassium</i>	$2\text{K} + \text{Cl}_2 \rightarrow 2\text{KCl}$

(b) $\text{Li} \rightarrow \text{Na} \rightarrow \text{K}$

3. (a) Kumpulan 1, Kala 2 / *Group 1, Period 2*
- (b) Atom Z kurang reaktif berbanding dengan natrium. Saiz atom Z lebih kecil berbanding dengan natrium. Kedudukan elektron valens daripada nukleus atom Z lebih dekat

berbanding dengan natrium. Lebih sukar untuk atom Z membebaskan elektron valensnya berbanding dengan natrium.

Atom Z is less reactive than sodium. Atomic size of Z is smaller than sodium. The position of valence electron from the nucleus of atom Z is closer than sodium. It is harder for atom Z to release its valence electron than sodium.

4. (a) ✓ (c) ✓ (d) ✓ (f) ✓

4.5 Unsur dalam Kumpulan 17 Elements in Group 17

- Halogen
Halogens
 - 7
 - 2.8.7
 - Br^-
 - Keadaan jirim / *State of matter*: Cecair / *Liquid*
Warna / *Colour*: Perang kemerahan / *Reddish brown*
 - Bromin mempunyai takat lebur dan takat didih yang lebih tinggi berbanding dengan klorin. Hal ini kerana saiz molekul bromin lebih besar berbanding dengan molekul klorin. Daya tarikan antara molekul bromin lebih kuat berbanding dengan molekul klorin. Oleh itu, lebih banyak tenaga haba yang diperlukan untuk mengatasi daya tarikan antara molekul bromin berbanding dengan molekul klorin.
Bromine has a higher melting point and boiling point than chlorine. This is because the size of bromine molecule is bigger than chlorine molecule. Force of attraction between bromine molecule is stronger than chlorine molecule. Therefore, More heat is needed to overcome the force of attraction between bromine molecule than chlorine molecule.
- Bertambah / *Increases*
 - Bertambah / *Increases*
 - Bertambah / *Increases*
 - Bertambah / *Increases*
 - Bertambah / *Increases*
- Ferum(III) klorida / *Iron(III) chloride*
 - $2\text{Fe} + 3\text{Cl}_2 \rightarrow 2\text{FeCl}_3$
 - Kalium hidroksida / *Potassium hydroxide* / KOH

- $\text{Br}_2 + 2\text{KOH} \rightarrow \text{KBr} + \text{KOB} + \text{H}_2\text{O}$
 - Fluorin lebih reaktif di dalam air berbanding dengan klorin. Saiz atom fluorin lebih kecil daripada atom klorin. Daya tarikan antara nukleus terhadap elektron dalam atom fluorin lebih kuat berbanding dengan atom klorin. Oleh itu, lebih mudah untuk atom fluorin menerima elektron berbanding dengan atom klorin.
- $2\text{F}_2 + 2\text{H}_2\text{O} \rightarrow 4\text{HF} + \text{O}_2$
 - Fluorin lebih reaktif di dalam air berbanding dengan klorin. Saiz atom fluorin lebih kecil daripada atom klorin. Daya tarikan antara nukleus terhadap elektron dalam atom fluorin lebih kuat berbanding dengan atom klorin. Oleh itu, lebih mudah untuk atom fluorin menerima elektron berbanding dengan atom klorin.

Fluorine is more reactive in water than chlorine. Atomic size of fluorine is smaller than chlorine. Force of attraction between nucleus towards electrons in fluorine atom is stronger than chlorine atom. Therefore, it is easier for fluorine atom to accept an electron compared to chlorine atom.

4. (a) ✓
(c) ✓
(e) ✓

4.6 Unsur dalam Kala 3 Elements in Period 3

- Berkurang / *Decreases*
 - Bertambah / *Increases*
 - Bertambah / *Increases*
 - Bertambah / *Increases*
 - Bertambah / *Increases*
- petala / *shells*
 - pepejal kepada gas / *solid to gas*
 - gas / *gases*
 - pepejal / *solids*
 - logam / *metal*
 - metalloid / *metalloid*
 - bukan logam / *non-metal*
 - proton / *protons*
- Oksida bes / *Basic oxide*
 - Oksida amfoterik / *Amphoteric oxide*
 - Oksida asid / *Acidic oxide*
 - Oksida bes / *Basic oxide*
 - Oksida asid / *Acidic oxide*
 - Oksida asid / *Acidic oxide*
 - Oksida asid / *Acidic oxide*

4. A. Tindak balas oksida unsur Kala 3 dengan air

Reaction of oxides of Period 3 elements with water

Oksida <i>Oxide</i>	Natrium oksida, Na ₂ O <i>Sodium oxide, Na₂O</i>	Magnesium oksida, MgO <i>Magnesium oxide, MgO</i>	Aluminium oksida, Al ₂ O ₃ <i>Aluminium oxide, Al₂O₃</i>	Sulfur dioksida, SO ₂ <i>Sulphur dioxide, SO₂</i>
(a) Keterlarutan di dalam air <i>Solubility in water</i>	Larut <i>Dissolves</i>	Larut sedikit <i>Dissolves slightly</i>	Tidak larut <i>Does not dissolve</i>	Larut <i>Dissolves</i>
(b) Nilai pH <i>pH value</i>	13 – 14	8 – 9	7	2 – 3

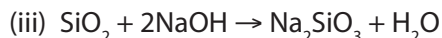
B. Tindak balas oksida unsur Kala 3 dengan natrium hidroksida dan asid nitrik

Reaction of oxides of Period 3 elements with sodium hydroxide and nitric acid

Oksida <i>Oxide</i>	Keterlarutan <i>Solubility</i>	
	Di dalam natrium hidroksida, NaOH <i>In sodium hydroxide, NaOH</i>	Di dalam asid nitrik, HNO ₃ <i>In nitric acid, HNO₃</i>
(a) Magnesium oksida, MgO <i>Magnesium oxide, MgO</i>	Tidak larut <i>Does not dissolve</i>	Larut <i>Dissolves</i>
(b) Aluminium oksida, Al ₂ O ₃ <i>Aluminium oxide, Al₂O₃</i>	Larut <i>Dissolves</i>	Larut <i>Dissolves</i>
(c) Silikon(IV) oksida, SiO ₂ <i>Silicon(IV) oxide, SiO₂</i>	Larut <i>Dissolves</i>	Tidak larut <i>Does not dissolve</i>

Perbincangan / Discussion:

- (a) (i) Natrium oksida, Na₂O, magnesium oksida, MgO
Sodium oxide, Na₂O, magnesium oxide, MgO
- (ii) Aluminium oksida, Al₂O₃
Aluminium oxide, Al₂O₃
- (iii) Silikon(IV) oksida, SiO₂, fosforus pentoksida, P₄O₁₀, sulfur dioksida, SO₂, diklorin heptoksida, Cl₂O₇
Silicon(IV) oxide, SiO₂, phosphorus pentoxide, P₄O₁₀, sulphur dioxide, SO₂, dichlorine heptoxide, Cl₂O₇
- (b) (i) MgO + 2HNO₃ → Mg(NO₃)₂ + H₂O
- (ii) Al₂O₃ + 2NaOH → 2Al(NO₃)₃ + H₂O
Al₂O₃ + 6HNO₃ → 2NaAlO₂ + 3H₂O



5. • Silikon / *Silicon*
- Apabila suhu tinggi, silikon menjadi konduktor elektrik yang baik.
When the temperature is high, silicon becomes a good electrical conductor.
- Ini membolehkannya digunakan sebagai mikrochip elektronik yang beroperasi pada suhu tinggi.
This allows it to be used as an electronic microchip that operates at high temperatures.

4.7 Unsur Peralihan
Transition Elements

1. (a) 3, 12
(b) logam / *metals*
(c) berkilat / *shiny*
(d) ketumpatan, takat lebur, takat didih
densities, melting points, boiling points

2.

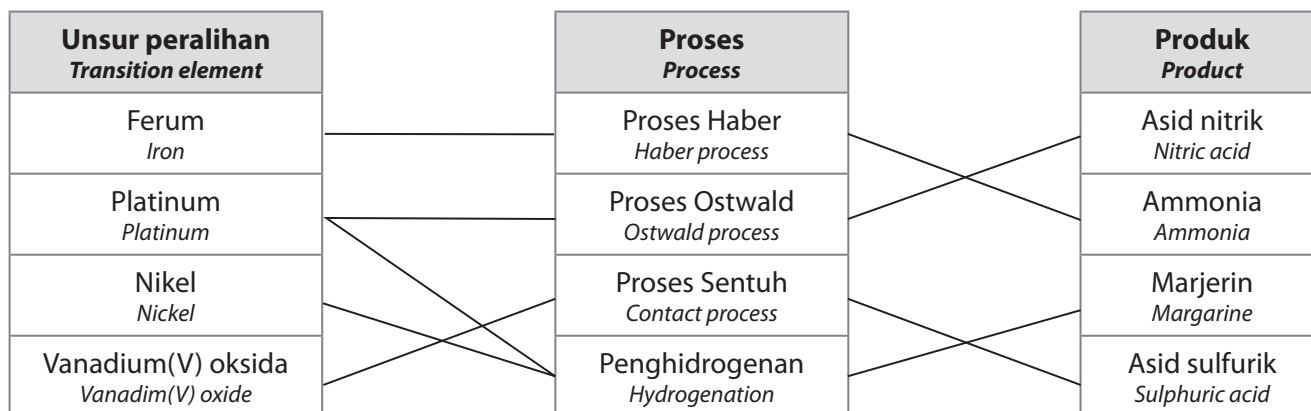
Ciri istimewa <i>Special characteristic</i>	Contoh <i>Example</i>	Jawapan <i>Answer</i>
(a) Digunakan sebagai mangkin <i>Used as catalysts</i>	Ferum, Fe digunakan dalam Proses Ostwald untuk menghasilkan asid nitrik. <i>Iron, Fe is used in the Ostwald Process to produce nitric acid.</i>	
	Ferum digunakan dalam Proses Haber untuk menghasilkan ammonia. <i>Iron is used in the Haber Process to produce ammonia.</i>	✓

Ciri istimewa <i>Special characteristic</i>	Contoh <i>Example</i>	Jawapan <i>Answer</i>
(b) Membentuk ion atau sebatian berwarna. <i>Form coloured ions or compounds</i>	Ion ferum(II), Fe^{2+} berwarna hijau, manakala ion ferum(III), Fe^{3+} berwarna perang. <i>Iron (II), Fe^{2+} ions are green, while iron (III), Fe^{3+} ions are brown.</i>	✓
	Ion ferum(II), Fe^{2+} berwarna perang, manakala ion ferum(III), Fe^{3+} berwarna hijau. <i>Iron (II), Fe^{2+} ions are brown, while iron (III), Fe^{3+} ions are green.</i>	
(c) Mempunyai lebih daripada satu nombor pengoksidaan <i>Have more than one oxidation numbers</i>	Mangan, Mn mempunyai nombor pengoksidaan +3 dan +6. <i>Mangan, Mn has +3 and +6 oxidation numbers.</i>	
	Kuprum, Cu mempunyai nombor pengoksidaan +1 dan +2. <i>Copper, Cu has +1 and +2 oxidation numbers.</i>	✓

Ciri istimewa <i>Special characteristic</i>	Contoh <i>Example</i>	Jawapan <i>Answer</i>
(d) Membentuk ion kompleks <i>Form complex ions</i>	Ion heksasianoferat(III), $[\text{Fe}(\text{CN})_6]^{3-}$ <i>Hexacyanoferrate(III) ion, $[\text{Fe}(\text{CN})_6]^{3-}$</i>	✓
	Ion ferum(II) oksida, FeO <i>Iron(II) oxide ion, FeO</i>	

3. (a) Unsur peralihan / *Transition elements*
 (b) Berfungsi sebagai mangkin / membentuk ion atau sebatian berwarna / mempunyai lebih daripada satu nombor pengoksidaan / boleh membentuk ion kompleks
Act as catalysts / form coloured ions or compounds / have more than one oxidation number / can form complex ions
 (c) Unsur peralihan lebih keras, lebih kuat, mempunyai ketumpatan yang lebih tinggi, takat lebur dan didih yang lebih tinggi berbanding dengan unsur Kumpulan 1.
Transition elements are harder, stronger, have higher densities, higher melting point and boiling point compared to Group 1 elements.

4.





1. (a) Ferum

Iron

Kumpulan 8, Kala 4

Group 8, Period 4

- (b) Ferum bertindak sebagai mangkin. Mangkin menyediakan laluan alternatif dalam tindak balas. Mangkin merendahkan tenaga pengaktifan dan seterusnya meningkatkan kadar tindak balas. Lebih banyak ammonia dapat dihasilkan.

Iron acts as catalyst. Catalyst provides an alternative pathway in the reaction. Catalyst lowers the activation energy and then increases the rate of reaction. More ammonia can be produced.

- (c)
- Vanadium(V) oksida digunakan dalam Proses Sentuh untuk menghasilkan asid sulfurik.
Vanadium(V) oxide is used in the Contact Process to produce sulphuric acid.
 - Platinium digunakan dalam Proses Ostwald untuk menghasilkan asid nitrik.
Platinum is used in the Ostwald Process to produce nitric acid.

JAWAPAN

PRAKTIS SPM 2

Bab 3 - Bab 4

KERTAS 1

1. A 2. C 3. D 4. C 5. D
6. A 7. A 8. B 9. B 10. A
11. B 12. C 13. D 14. D

KERTAS 2

Bahagian A

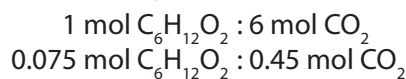
1. (a) Formula molekul / Molecular formula: $C_6H_{12}O_2$
Formula empirik / Empirical formula: C_3H_6O

(b) $= 6(12) + 12(1) + 2(16)$
 $= 116$



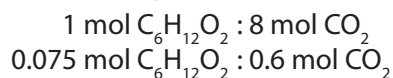
(d) (i) Bilangan mol gas CO_2
Number of moles of CO_2 gas
 $= \frac{10.8}{24}$
 $= 0.45 \text{ mol}$

Nisbah mol / Mole ratio



Jisim sebatian / Mass of compound
 $= 0.075 \times 116$
 $= 8.7 \text{ g}$

(ii) Nisbah mol / Mole ratio



Isi padu minimum gas oksigen
Minimum volume of oxygen gas
 $= 0.6 \times 24$
 $= 14.4 \text{ dm}^3$

2. (a) Lajur menegak dalam Jadual Berkala Unsur.
Vertical column in the Periodic Table of Elements.
(b) Halogen / Halogens
(c) • Saiz molekul Y lebih kecil daripada molekul Z / Daya tarikan antara molekul / van der Waals antara molekul lebih lemah dalam molekul Y berbanding dengan molekul Z.

The size of molecule Y is smaller than molecule Z / The force of attraction between molecules / The van der Waals attraction forces between molecules are weaker in molecule Y than Z.

- Sedikit tenaga haba diperlukan untuk mengatasi daya tarikan antara molekul bagi Y berbanding Z.
Less heat energy is required to overcome the force of attraction between molecules for Y than Z.
- (d) (i) $2Na + W_2 \rightarrow 2NaW$
(ii) • W lebih reaktif berbanding X.
W is more reactive than X.
• Saiz atom W lebih kecil daripada atom X. // Bilangan petala berisi elektron dalam atom W kurang berbanding dengan atom X.
The atomic size of W is smaller than atom X. // The number of shells filled with electrons in atom W is less than atom X.
• Daya tarikan antara nukleus dan elektron valens atom W lebih kuat daripada atom X. // Atom W lebih cenderung menerima elektron berbanding dengan atom X kerana daya tarikan yang lebih kuat.
The attraction force between the nucleus and valence electrons in atom W is stronger than atom X. // Atom W has a higher tendency to receive electron than atom X because of the stronger attraction force.

Bahagian B

3. (a) (i) Formula yang menunjukkan bilangan sebenar atom bagi setiap unsur di dalam sebatian.
Formula that shows the actual number of atoms of each element in the compound.
(ii) • Formula empirik bagi asid askorbik ialah $C_3H_4O_3$.
Empirical formula of ascorbic acid is $C_3H_4O_3$.
• Satu molekul asid askorbik mengandungi 6 atom karbon, 8 atom hidrogen dan 6 atom oksigen.
A molecule of ascorbic acid contains 6 carbon atoms, 8 hydrogen atoms and 6 oxygen atoms.

- Jisim molekul relatif bagi asid askorbik:
Relative molecular mass of ascorbic acid:
 $6(12) + 8(1) + 6(16) = 176$

(b) (i)

Unsur <i>Element</i>	Karbon, C <i>Carbon, C</i>	Hidrogen, H <i>Hydrogen, H</i>
Jisim (%) <i>Mass (%)</i>	85.71	14.29
Bilangan mol atom <i>Number of moles of atom</i>	$\frac{85.71}{12} = 7.1425$	$\frac{14.29}{1} = 14.29$
Nisbah mol teringkas <i>Simplest mole ratio</i>	$\frac{7.1425}{7.1425} = 1$	$\frac{14.29}{7.1425} = 2$
Formula empirik <i>Empirical formula</i>	CH_2	

- (ii) Anggapkan formula molekul sebatian Q
 $= (\text{CH}_2)_n$

Assume that the molecular formula of compound Q = $(\text{CH}_2)_n$

$$(\text{CH}_2)_n = 42$$

$$[12 + 2(1)]n = 42$$

$$14n = 42$$

$$n = 3$$

$$(\text{CH}_2)_n = (\text{CH}_2)_3 = \text{C}_3\text{H}_6$$

Maka, formula molekul bagi sebatian Q ialah C_3H_6 .

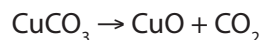
Therefore, the molecular formula of compound Q is C_3H_6 .

- (c) • Jisim molekul relatif NH_4NO_3 dan $\text{CO}(\text{NH}_2)_2$
 $\text{JMR } \text{NH}_4\text{NO}_3 = 14 + 4(1) + 14 + 3(16) = 80$
 $\text{JMR } \text{CO}(\text{NH}_2)_2 = 12 + 16 + 2(14) + 4(1) = 60$
Relative molecular mass of NH_4NO_3 and $\text{CO}(\text{NH}_2)_2$
RMM $\text{NH}_4\text{NO}_3 = 14 + 4(1) + 14 + 3(16) = 80$
RMM $\text{CO}(\text{NH}_2)_2 = 12 + 16 + 2(14) + 4(1) = 60$
- Peratus nitrogen mengikut jisim dalam NH_4NO_3
Percentage of nitrogen by mass in NH_4NO_3
 $= \frac{2(14)}{80} \times 100\% = 35\%$
 - Peratus nitrogen mengikut jisim dalam $\text{CO}(\text{NH}_2)_2$ / *Percentage of nitrogen by mass in $\text{CO}(\text{NH}_2)_2$*
 $= \frac{2(14)}{60} \times 100\% = 46.67\%$
 - Urea, $\text{CO}(\text{NH}_2)_2$ ialah baja yang lebih baik untuk pertumbuhan tanaman.
Urea, $\text{CO}(\text{NH}_2)_2$ is the better fertiliser for the growth of the plants.

- Kerana peratus nitrogen mengikut jisim dalam urea lebih tinggi daripada ammonium nitrat.

Because the percentage of nitrogen by mass in urea is higher than ammonium nitrate.

- (d) • Persamaan kimia / *Chemical equation:*



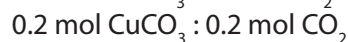
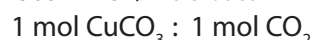
- Jisim molekul relatif CuCO_3
 $= 14 + 4(1) + 14 + 3(16) = 80$

Relative molecular mass of CuCO_3
 $= 14 + 4(1) + 14 + 3(16) = 80$

- Bilangan mol bagi CuCO_3
Number of moles of CuCO_3

$$= \frac{24.8}{124} = 0.2 \text{ mol}$$

- Nisbah mol / *Mole ratio:*



- Isi padu gas karbon dioksida yang dihasilkan

Volume of carbon dioxide gas produced

$$= 0.2 \times 24$$

$$= 4.8 \text{ dm}^3$$

4. (a) (i) X: Kumpulan 17, Kala 3 / *Group 17, Period 3*

Y: Kumpulan 1, Kala 3 / *Group 1, Period 3*

- (ii) • X: Gas / *Gas*

Y: Pepejal / *Solid*

- X: 2.8.7

Y: 2.8.1

- Saiz jejari atom X lebih kecil berbanding dengan atom Y kerana bilangan proton atom X lebih banyak daripada atom Y.

Atomic radius of atom X is smaller than atom Y because the number of protons of atom X is greater than atom Y.

- Daya tarikan nukleus terhadap elektron dalam atom X lebih kuat berbanding dengan atom Y.

The attraction force of nucleus towards the electrons in atom X is stronger than atom Y. So, the electronegativity of atom X is higher than atom Y.

- Atom X lebih cenderung untuk menerima satu elektron valens, manakala atom Y lebih cenderung untuk menderma satu elektron ke dalam petala valens supaya kedua-dua atom mencapai susunan elektron oktet yang stabil.

Atom X has the tendency to receive one valence electron, whereas atom Y has the tendency to donate one electron into its valence shell in order for them to achieve stable octet electron arrangements.

(iii) Natrium klorida, NaCl / Sodium chloride, NaCl
 $2X + Y_2 \rightarrow 2XY$ atau / or $2Na + Cl_2 \rightarrow 2NaCl$

(b) (i)

V	W
Bergerak secara rawak di atas permukaan air dengan bunyi desiran dan nyalaan kuning terang. <i>Moves randomly on the water surface with a fizzing sound and a bright yellow flame.</i>	Bergerak sangat pantas secara rawak di atas permukaan air dengan menghasilkan bunyi 'pop' dan nyalaan ungu yang sangat terang. <i>Moves very rapidly at random on the water surface with a 'pop' sound and a bright purple flame.</i>
Menukarkan kertas litmus merah kepada biru <i>Turns red litmus paper blue</i>	
Natrium <i>Sodium</i>	Kalium <i>Potassium</i>
<ul style="list-style-type: none"> Saiz atom V lebih kecil berbanding dengan atom W disebabkan oleh bilangan elektron atom V kurang daripada atom W. <i>The size of atom V is smaller than atom W because the number of electrons in atom V is less than atom W.</i> Elektron valens dalam atom V lebih dekat dengan nukleus berbanding dengan atom W. <i>The valence electron in atom V is closer to the nucleus than atom W.</i> Daya tarikan nukleus terhadap elektron valens dalam atom V lebih kuat berbanding dengan atom W. <i>The attraction force of the nucleus towards the valence electron in atom V is stronger than atom W.</i> Atom W lebih mudah mendermakan elektron valens berbanding dengan atom V. Maka, atom W lebih reaktif daripada atom V. <i>It is easier for atom W to donate the valence electron compared to atom V. Thus, atom W is more reactive than atom V.</i> 	
$2Na + 2H_2O \rightarrow NaOH + H_2$ atau / or $2V + 2H_2O \rightarrow 2VOH + H_2$	

(ii) $4K + O_2 \rightarrow 2K_2O$ atau / or $4W + O_2 \rightarrow 2W_2O$

Bahagian C

5. (a) (i) Formula kimia yang menunjukkan nisbah paling ringkas bagi bilangan atom setiap jenis unsur dalam sesuatu sebatian.

Chemical formula that shows the simplest ratio of the numbers of atoms of each type of element in a compound.

(ii) Sebelum / Before:

Untuk menyingkirkan udara / gas oksigen di dalam salur kaca

To remove air / oxygen gas inside the glass tube

Selepas / After:

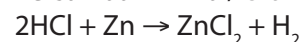
Untuk memastikan udara / gas oksigen tidak bertindak balas dengan kuprum

To ensure air / oxygen gas does not react with copper

(iii)

Unsur <i>Element</i>	Cu	O
Jisim (g) <i>Mass (g)</i>	4.48	1.12
Bilangan mol <i>Number of moles</i>	$\frac{4.48}{64} = 0.07$	$\frac{1.12}{16} = 0.07$
Nisbah mol teringkas <i>Simplest mole ratio</i>	1	1
Formula empirik <i>Empirical formula</i>	CuO	

Persamaan kimia / Chemical equation:



(b) (i) Prosedur / Procedure:

1. Logam M di bersihkan dengan kertas pasir.

Metal M is cleaned with sandpaper.

2. Mangkuk pijar ditimbang dengan penutup dan jisim direkodkan.

Crucible and lid are weighed and the mass is recorded.

3. Logam M dimasukkan ke dalam mangkuk pijar, ditimbang dan jisim direkodkan.

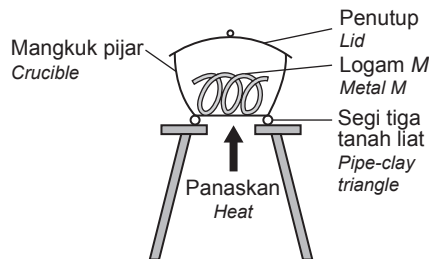
Metal M is placed in the crucible, weighed and the mass is recorded.

4. Mangkuk pijar dipanaskan sehingga logam M terbakar sepenuhnya.

The crucible is heated until metal M burns completely.

5. Semasa pembakaran, penutup diangkat dari semasa ke semasa dan segera diletakkan semula
While burning, the lid is lifted from time to time and quickly placed back
6. Mangkuk pijar disejukkan sehingga suhu bilik.
Crucible is cooled to room temperature.
7. Mangkuk pijar, penutup dan baki pemanasan ditimbang dan jisim direkodkan.
Crucible, lid and heating residue are weighed and the mass is recorded.
8. Langkah 4 hingga 6 diulangi sehingga jisim yang tetap diperoleh.
Steps 4 to 6 are repeated until a constant mass is obtained.

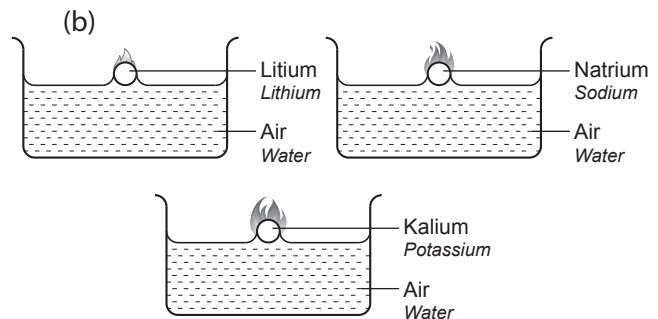
Gambar rajah berlabel
Labelled diagram



- (ii) Bilangan mol logam *M*
Number of moles of metal M
- $$= \frac{18}{24}$$
- $$= 0.75 \text{ mol}$$
- Nisbah mol / *Mole ratio*
2 mol *M* : 1 mol O₂
0.75 mol *M* : 0.375 mol O₂
- Isi padu gas oksigen / *Volume of oxygen gas*
= 0.375 × 24
= 9 dm³

6. (a) (i) Sebatiannya yang boleh bertindak sebagai asid dan bes.
Compound that can act as both acid and base.
- A: Natrium oksida / Magnesium oksida
Sodium oxide / Magnesium oxide
- B: Aluminium oksida / Aluminium oksida
Aluminium oxide / Aluminium oxide
- C: Sulfur dioksida / Fosforus(V) oksida / Diklorin heptoksida / Silikon(IV) oksida
Sulphur dioxide / Phosphorus(V) oxide / Dichlorine heptoxide / Silicon(IV) oxide

- (ii)
- pH 8 hingga 14 / Lebih daripada pH 7
pH 8 to 14 / More than pH 7
 - Masukkan kertas litmus merah ke dalam larutan yang terhasil.
Insert red litmus paper into the solution.
 - Kertas litmus merah menjadi biru.
Red litmus paper turns blue.
 - Gunakan penunjuk fenolftalein.
Use phenolphthalein indicator.
 - Larutan tak berwarna menjadi merah jambu. / Colourless solution turns pink.
$$\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2\text{NaOH} /$$
$$\text{MgO} + \text{H}_2\text{O} \rightarrow \text{Mg(OH)}_2$$



Prosedur / *Procedure:*

1. Litium dipotong kecil dengan menggunakan pisau dan forseps dan dikeringkan menggunakan kertas turas.
Lithium is cut into a small size using a knife and forceps and dried using a filter paper.
2. Potongan litium diletakkan secara perlahan-lahan ke dalam besen yang berisi air seperti dalam rajah susunan radas.
A piece of lithium is slowly placed into a basin filled with water as in the apparatus set-up diagram.
3. Tindak balas diperhatikan sehingga selesai. Larutan diuji menggunakan kertas litmus merah.
The reaction is observed until completed. The solution is tested with a red litmus paper.
4. Pemerhatian direkodkan.
The observation is recorded.
5. Langkah 1 hingga 4 diulangi menggunakan natrium dan kalium.
Steps 1 to 4 are repeated using sodium and potassium.

Pemerhatian / Observation:

Logam <i>Metals</i>	Pemerhatian <i>Observation</i>
Litium <i>Lithium</i>	<ul style="list-style-type: none"> Litium bergerak perlahan secara rawak di atas permukaan air. <i>Lithium moves randomly on the surface of water.</i> Larutan tidak berwarna menukarkan kertas litmus merah kepada biru. <i>The colourless solution turns red litmus paper blue.</i>
Natrium <i>Sodium</i>	<ul style="list-style-type: none"> Natrium bergerak laju di atas permukaan air dengan bunyi desiran dan nyalaan kuning terang. <i>Sodium moves fast on the surface of water with a fizzing sound and a bright yellow flame.</i> Larutan tak berwarna menukarkan kertas litmus merah kepada biru. <i>The colourless solution turns red litmus paper blue.</i>

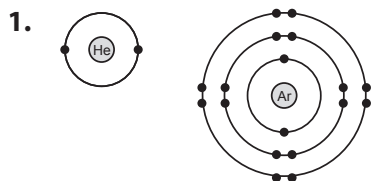
 Kalium
Potassium

- Kalium bergerak sangat laju di atas permukaan air dengan bunyi 'pop' dan nyalaan ungu terang.
Potassium move randomly on the surface of water with a 'pop' sound and a bright purple flame.
- Larutan tidak berwarna menukarkan kertas litmus merah kepada biru.
The colourless solution turns red litmus paper blue.

Persamaan kimia / Chemical equations:

- $2\text{Li} + 2\text{H}_2\text{O} \rightarrow 2\text{LiOH} + \text{H}_2$
- $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$
- $2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$

5.1 Asas Pembentukan Sebatian Basics of Compound Formation



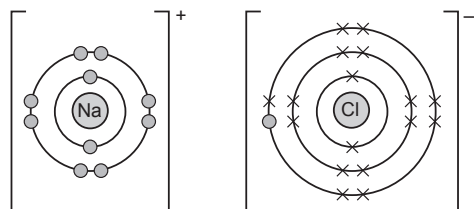
2. (a) ✓ (d) ✓ (e) ✓

5.2 Ikatan Ion Ionic Bond

1. (a) Natrium / Sodium: 2.8.1
Klorin / Chlorine: 2.8.7

(b) NaCl

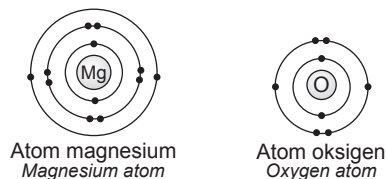
- (c) (i) Ikatan ion / Ionic bond
(ii)



- (i) Atom Na menderma satu elektron untuk mencapai susunan elektron oktet yang stabil membentuk ion Na^+ . Atom Cl menerima satu elektron untuk mencapai susunan elektron oktet yang stabil membentuk ion Cl^- . Ion Na^+ dan ion Cl^- tertarik oleh daya tarikan elektrostatik yang kuat.

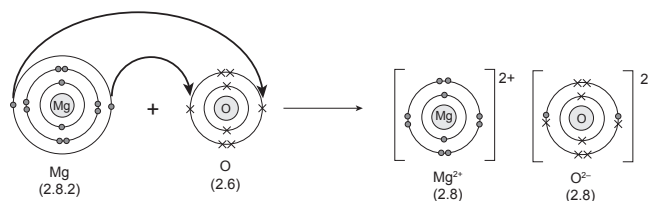
Na atom donates an electron to achieve a stable octet electron arrangement to form Na^+ ion. Cl atom receives an electron to achieve a stable octet electron arrangement to form Cl^- ion. Na^+ ion and Cl^- ion are attracted by a strong electrostatic attraction force.

2. (a)

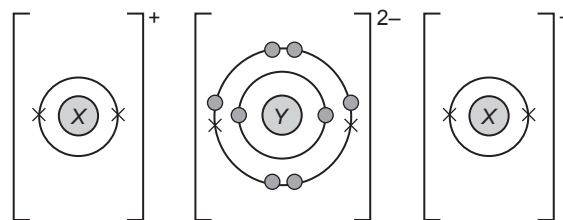


- (b) (i) menderma dua / donates two
(ii) +2
(c) (i) menerima dua / receives two
(ii) -2
(d) (i) 2.8
(ii) 2.8
(iii) lapan, terluar / valens
eight, outermost / valence

(e)



3. (a) (i) X_2Y
(ii) $4X + Y_2 \rightarrow 2X_2Y$
(b) (i) Ikatan ion / Ionic bond
(ii)

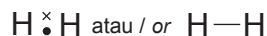
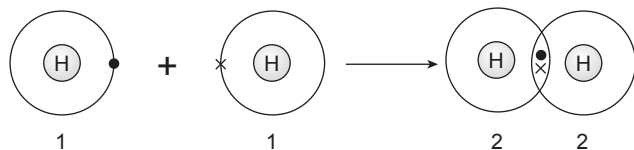


- (iii) Ikatan kimia antara atom X dengan atom Y terbentuk melalui pemindahan elektron. Dua atom X menderma satu elektron untuk mencapai susunan elektron duplet yang stabil membentuk ion X^+ . Satu atom Y menerima dua elektron untuk mencapai susunan elektron oktet yang stabil membentuk ion Y^{2-} . Dua ion X^+ dan satu ion Y^{2-} tertarik oleh daya tarikan elektrostatik yang kuat.

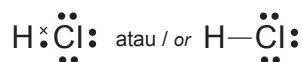
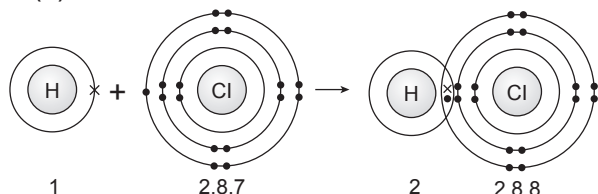
Chemical bond between atom X and atom Y is formed through the transfer of electrons. Two atoms X donate one electron to achieve stable duplet electron arrangements to form ion X^+ . One atom Y receives two electrons to achieve a stable octet electron arrangement to form ion Y^{2-} . Two ions X^+ and one ion Y^{2-} are attracted by a strong electrostatic attraction force.

5.3 Ikatan Kovalen
 Covalent Bond

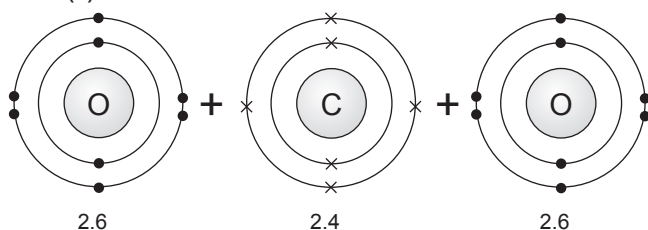
1. (a)



(b)

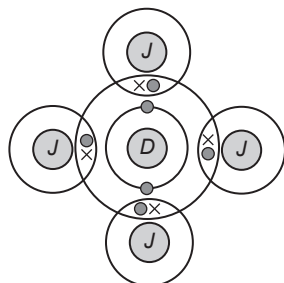


(c)


 2. (a) (i) *D* dan *J* / *D* and *J*

(b) (i) Ikatan kovalen / Covalent bond

(ii)



(iii) Atom *D* memerlukan empat elektron untuk mencapai susunan elektron oktet yang stabil. Atom *J* memerlukan satu elektron untuk mencapai susunan elektron duplet yang stabil. Satu atom *D* menyumbang empat elektron untuk dikongsi. Empat atom *J* menyumbang satu elektron untuk dikongsi. Satu atom *D* berkongsi elektron dengan empat atom *J* untuk membentuk sebatian kovalen dengan formula kimia DJ_4 .

Atom D needs four electrons to achieve a stable octet electron arrangement. *Atom J* needs one electron to achieve a stable duplet electron arrangement. One *atom D* contributes four electrons to be shared. Four *atoms J* contribute one electron to be shared. One *atom D* shares electrons with four *atoms J* to form a covalent compound with the chemical formula DJ_4 .

(c)

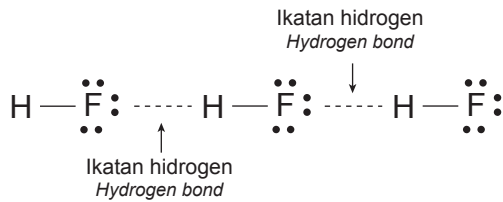
Ikatan kimia di 2(b)(i) Chemical bond in 2(b)(i)	Ikatan kimia antara atom <i>J</i> dengan atom natrium Chemical bond between atom <i>J</i> and sodium atom
Persamaan Similarities	
Melibatkan elektron valens Involves valence electrons	
Atom-atom mencapai susunan elektron duplet atau oktet yang stabil Atoms achieved a stable duplet or octet electron arrangement	
Perbezaan Differences	
Melibatkan perkongsian elektron Involves sharing of electrons	Melibatkan pemindahan elektron Involves transfer of electron
Terbentuk antara atom bukan logam Formed between non-metal atoms	Terbentuk antara atom logam dengan atom bukan logam Formed between metal atom and non-metal atom
Membentuk molekul Forms a molecule	Membentuk kation dan anion Forms cation and anion

5.4 Ikatan Hidrogen
Hydrogen Bond

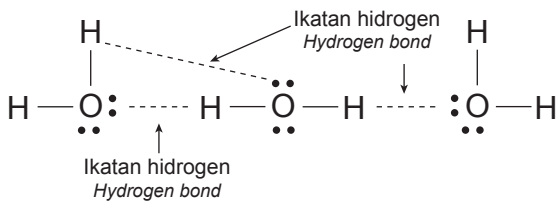
1. Ikatan hidrogen ialah daya tarikan antara atom hidrogen, H yang terikat dengan atom yang mempunyai keelektronegatifan yang tinggi iaitu fluorin, F, oksigen, O atau nitrogen, N dengan atom nitrogen, N, oksigen, O atau fluorin, F di dalam molekul lain.

Hydrogen bond is the attraction force between a hydrogen atom, H bonded to an atom of high electronegativity which are fluorine, F, oxygen, O and nitrogen, N with nitrogen, N, oxygen, O or fluorine, F in another molecule.

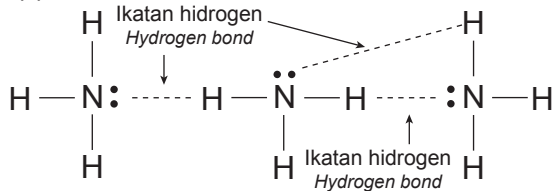
2. (a)



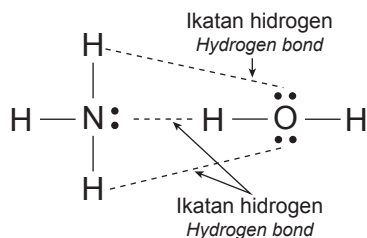
(b)



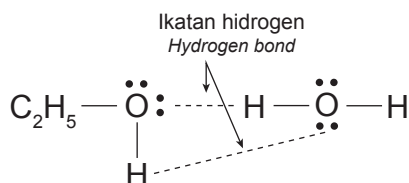
(c)



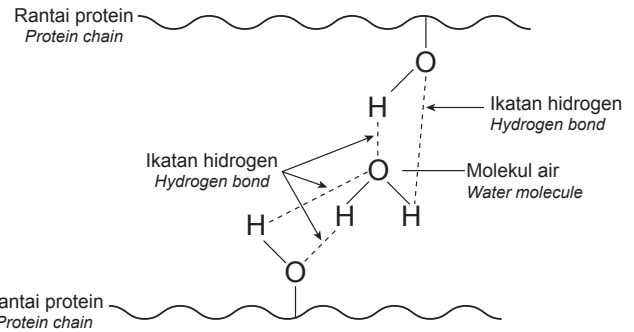
3. (a)



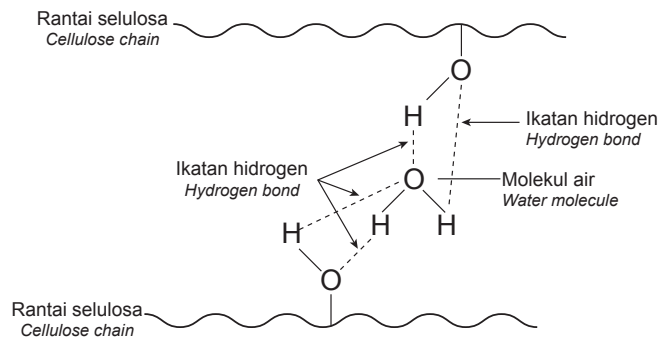
(b)



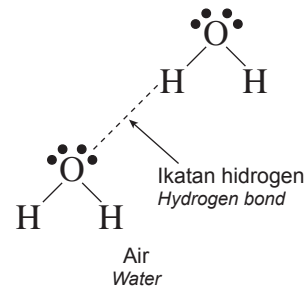
4. (a)



(b)



5. (a) (i)



(ii) Tidak. Atom sulfur, S tidak mempunyai keelektronegatifan yang tinggi. Maka, atom hidrogen, H yang terikat dengan atom sulfur, S tidak dapat membentuk ikatan hidrogen dengan atom oksigen, O dalam molekul air, H₂O.

No. Sulfur atom, S does not have high electronegativity. Thus, the hydrogen atom, H that is bonded to sulphur atom, S cannot form a hydrogen bond with the oxygen atom, O in the water molecule, H₂O.

(b) (i) Air / Water: Cecair / Liquid

Hidrogen sulfida / Hydrogen sulphide: Gas / Gas

- (ii) Ikatan hidrogen dan daya tarikan van der Waals terbentuk antara molekul air, manakala hanya daya tarikan van der Waals terbentuk antara molekul hidrogen sulfida. Lebih banyak tenaga haba diperlukan untuk memutuskan ikatan hidrogen dan mengatasi daya tarikan van der Waals antara molekul air, manakala kurang tenaga haba diperlukan untuk mengatasi daya antara molekul hidrogen sulfida.

Hydrogen bond and van der Waals attraction force are formed between water molecules, while only van der Waals attraction force is formed between hydrogen sulphide molecules. More heat energy is needed to break the hydrogen bond and overcome the van der Waals attraction force in between water molecules, while less heat energy is needed to overcome the van der Waals attraction force in between hydrogen sulphide molecules.

5.5 Ikatan Datif Dative Bond

1. (a) Ikatan kovalen yang pasangan elektron dikongsi berasal daripada satu atom sahaja.
Covalent bond which the electron pair shared comes from one atom only.

2.

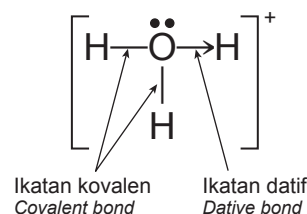
Jenis ikatan <i>Type of bond</i>	Ikatan kovalen <i>Covalent bond</i>	Ikatan datif <i>Dative bond</i>
Persamaan <i>Similarity</i>	Kedua-dua ikatan melibatkan perkongsian elektron. <i>Both bonds involve the sharing of electrons.</i>	
Perbezaan <i>Difference</i>	Dua elektron disumbangkan oleh dua atom. <i>Two electrons are contributed by two atoms.</i>	Dua elektron disumbangkan oleh satu atom. <i>Two electrons are contributed by one atom.</i>

5.6 Ikatan Logam Metallic Bond

1. Persamaan / *Similarity*:

- Kedua-dua struktur terdiri daripada struktur kekisi.
Both structures are made up of lattice structures.
- Kedua-dua struktur bergantung kepada daya tarikan elektrostatik yang kuat.
Both structures depend on strong electrostatic forces of attraction.
- Kedua-dua struktur mempunyai takat lebur dan takat didih yang tinggi.
Both structures have high melting and boiling points.

(b)



- (c) Atom oksigen telah mencapai susunan elektron oktet yang stabil dalam molekul air. Atom hidrogen telah mencapai susunan elektron duplet yang stabil dalam molekul air. Ion hidrogen, H^+ tidak mempunyai elektron di dalam petala. Pasangan elektron bebas daripada atom oksigen yang tidak terlibat dengan ikatan kovalen dalam molekul air dikongsi dengan ion hidrogen, H^+ melalui pembentukan ikatan datif.

Oxygen atom has achieved a stable octet electron arrangement in the water molecule. Hydrogen atoms have achieved stable duplet electron arrangements in the water molecule. Hydrogen ion, H^+ does not have electrons in its shell. Lone pair of electrons from the oxygen atom that are not involved with the covalent bonds in the water molecule is shared with hydrogen ion, H^+ through the formation of a dative bond.

- Kedua-dua struktur mengalirkan elektrik dalam keadaan lebur.
Both structures conduct electricity in the molten state.

Perbezaan / *Differences*:

- Dalam keadaan pepejal, ikatan logam membenarkan arus mengalir melaluinya, tetapi tidak bagi ikatan ion.
In the solid state, the metallic bond allows current to flow through it, but not for the ionic bond.
- Sebatian ion biasanya larut di dalam air, logam tidak larut di dalam air.
Ionic compounds are usually soluble in water, metals are not.

2. • Struktur logam terdiri daripada ion positif (ion logam) yang dikelilingi lautan elektron.
The structure of a metal is made up of positive ions (metal ions) surrounded by a sea of electrons.
 - Elektron di dalam lautan elektron bergerak bebas dalam keadaan pepejal dan cecair.
The electrons in the sea of electrons are free-moving in the solid and liquid states.
 - Elektron adalah pembawa cas dan bertanggungjawab mengkonduksikan elektrik. Jadi, logam mengalirkan elektrik dalam keadaan pepejal dan leburan.
Electrons are charge carriers and are responsible for electrical conductivity. Hence, metals conduct electricity in the solid and molten states.
 - Bilangan elektron yang disumbangkan ke dalam lautan elektron bertambah dari natrium (1 elektron valens) ke magnesium (2 elektron valens) ke aluminium (3 elektron valens).
The number of electrons contributed to the sea of electrons increases from sodium (1 valence electron) to magnesium (2 valence electrons) to aluminium (3 valence electrons).
 - Lebih banyak elektron dalam lautan elektron, lebih tinggi kekonduksian elektrik logam.
The more electrons in the sea of electrons, the higher the electrical conductivity of the metal.

5.7 Sebatian Ion dan Sebatian Kovalen *Ionic Compounds and Covalent Compounds*

1. A. Kekonduksian elektrik *Electrical conductivity* Keputusan / Result:

Sebatian Compound	Keadaan fizik Physical state	Pemerhatian Observation
Plumbum(II) bromida <i>Lead(II) bromide</i>	Pepejal <i>Solid</i>	Mentol tidak menyala <i>Bulb does not light up</i>
	Leburan <i>Molten</i>	Mentol menyala <i>Bulb lights up</i>
Naftalena <i>Naphthalene</i>	Pepejal <i>Solid</i>	Mentol tidak menyala <i>Bulb does not light up</i>
	Leburan <i>Molten</i>	Mentol tidak menyala <i>Bulb does not light up</i>

B. Keterlarutan sebatian dalam air dan pelarut organik *Solubility of compound in water and organic solvent* Keputusan / Result:

Sebatian Compound	Pemerhatian Observation	
	Di dalam air suling <i>In distilled water</i>	Di dalam propanon <i>In propanone</i>
Natrium klorida <i>Sodium chloride</i>	Pepejal larut <i>Solid dissolves</i>	Pepejal tidak larut <i>Solid does not dissolve</i>
Naftalena <i>Naphthalene</i>	Pepejal tidak larut <i>Solid does not dissolve</i>	Pepejal larut <i>Solid dissolves</i>

C. Takat lebur dan takat didih *Melting point and boiling point* Keputusan / Result:

Sebatian Compound	Pemerhatian Observation	Inferens Inference
Natrium klorida <i>Sodium chloride</i>	Pepejal tidak melebur <i>Solid does not melt</i>	<ul style="list-style-type: none"> - Takat lebur tinggi / Takat lebur melebihi 100 °C <i>High melting point / Melting point is higher than 100 °C</i> - Takat didih lebih tinggi <i>Boiling point is higher</i>
Naftalena <i>Naphthalene</i>	Pepejal melebur <i>Solid melts</i>	<ul style="list-style-type: none"> - Takat lebur rendah / Takat lebur kurang daripada 100 °C <i>Low melting point / Melting point is lower than 100 °C</i> - Takat didih rendah <i>Boiling point is low</i>

(a) Perbincangan / Discussion:

Sifat Properties	Sebatian ion Ionic compounds	Sebatian kovalen Covalent compounds
Takat lebur dan takat didih <i>Melting point and boiling point</i>	• Tinggi <i>High</i>	• Rendah <i>Low</i>
Keterlarutan di dalam air dan pelarut organik <i>Solubility in water and organic solvents</i>	<ul style="list-style-type: none"> • Larut di dalam air <i>Soluble in water</i> • Tidak larut di dalam pelarut organik <i>Insoluble in organic solvents</i> 	<ul style="list-style-type: none"> • Tidak larut di dalam air <i>Insoluble in water</i> • Larut di dalam pelarut organik <i>Soluble in organic solvents</i>

Kekonduksian elektrik <i>Electrical conductivity</i>	<ul style="list-style-type: none"> Mengkonduksikan elektrik dalam keadaan leburan tapi tidak dalam keadaan pepejal <i>Conduct electricity in molten state but not in solid state</i> 	<ul style="list-style-type: none"> Tidak mengkonduksikan elektrik <i>Cannot conduct electricity</i>
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- (b) (i) bergerak bebas / *move freely*
 (ii) daya tarikan elektrostatik
electrostatic attraction forces
 (iii) daya tarikan elektrostatik
electrostatic attraction forces
 (iv) banyak tenaga haba, daya tarikan elektrostatik
more heat energy, electrostatic attraction forces
- (c) (i) neutral, tidak bercas
neutral, uncharged
 (ii) sedikit tenaga haba, daya tarikan van der Waals
less heat energy, van der Waals attraction forces
 (iii) bersifat neutral, tidak bercas
neutral, uncharged

2.

Benzena <i>Benzene</i>	Grafen <i>Graphene</i>
Struktur molekul <u>ringkas</u> . <i>Simple molecular structure.</i>	Struktur molekul <u>gergasi</u> . <i>Giant molecular structure.</i>
Saiz molekul <u>kecil</u> . <i>Small molecular size.</i>	Saiz molekul <u>sangat besar</u> . <i>Very large molecular size.</i>
Takat lebur dan takat didih <u>rendah</u> . <i>Low melting point and boiling point.</i>	Takat lebur dan takat didih <u>tinggi</u> . <i>High melting point and boiling point.</i>
<u>Sedikit</u> haba diperlukan untuk mengatasi <u>daya tarikan van der Waals</u> yang lemah antara molekul. <i>Less heat is needed to overcome the weak van der Waals attraction force between molecules.</i>	<u>Banyak</u> haba diperlukan untuk memutuskan <u>ikatan kovalen</u> yang kuat dalam molekul. <i>More heat is needed to break the strong covalent bonds in the molecule.</i>

3.

Kegunaan <i>Uses</i>	Sebatian ion <i>Ionic compound</i>	Sebatian kovalen <i>Covalent compound</i>
(a) Rumah <i>Domestic</i>	Natrium hidrogen karbonat dalam <u>serbuk penaik</u> . <i>Sodium hydrogen carbonate in baking powder.</i>	Asid etanoik dalam <u>cuka</u> . <i>Ethanoic acid in vinegars.</i>
(b) Perubatan <i>Medical</i>	Magnesium hidroksida dalam <u>ubat antasid</u> . <i>Magnesium hydroxide in antacids.</i>	Asid asetilsalisilik dalam <u>ubat aspirin</u> . <i>Acetylsalicylic acid in aspirins.</i>
(c) Pertanian <i>Agriculture</i>	Ammonium nitrat dalam <u>baja kimia</u> . <i>Ammonium nitrate in chemical fertilisers.</i>	Dikloro-difenil-trikloroetana dalam <u>racun serangga</u> . <i>Dichloro-diphenyl-trichloroethane in insecticides.</i>
(d) Perindustrian <i>Industrial</i>	Titanium dioksida ialah <u>pigmen putih dalam cat</u> . <i>Titanium dioxide is the white pigment in paints.</i>	Polivinil klorida dalam <u>paip PVC</u> . <i>Polyvinyl chloride in PVC pipes.</i>



KBAT EKSTRA BAB 5

- Berlian mempunyai struktur gergasi dengan ikatan kovalen yang kuat antara atom karbon. Banyak tenaga diperlukan untuk memutuskan beribu-ribu ikatan kovalen yang kuat. Maka, berlian sesuai untuk digunakan sebagai alatan pemotong kerana kuat dan keras. Grafit mempunyai struktur gergasi yang berlapis. Sedikit tenaga diperlukan untuk mengatasi daya tarikan van der Waals yang lemah antara lapisan. Hal ini menyebabkan lapisan-lapisan mudah menggelongsor di atas satu sama lain. Grafit adalah lembut dan sesuai untuk digunakan sebagai pelincir.
Diamond has a giant structure with strong covalent bonds between carbon atoms. A lot of energy is required to break thousands of strong covalent bonds. Hence, diamond is suitable to be used as cutting tools because it is strong and hard. Graphite has a giant layered structure. Less energy is required to overcome weak van der Waals attraction forces between layers. This allows the layers to slide over each other. Graphite is soft and suitable to be used as a lubricant.

Peranan Air dalam Menunjukkan Keasidan dan Kealkalian

6.1 The Role of Water in Showing Acidic and Alkaline Properties

- Bahan kimia yang mengion di dalam air untuk menghasilkan ion hidroksida, OH^- .
Chemical substance that ionises in water to produce hydroxide ions, OH^- .
 - Pelarut A / Solvent A:
Air / Water
Pelarut B / Solvent B:
Propanon / metil benzena / triklorometana
Propanone / methyl benzene / trichloromethane
 - Natrium hidroksida mengion di dalam pelarut A menghasilkan ion hidroksida tetapi tidak mengion di dalam pelarut B.
Sodium hydroxide ionises in solvent A to produce hydroxide ion but does not ionise in solvent B.
 - $\text{NaOH} \rightarrow \text{Na}^+ + \text{OH}^-$
 - Antasid / Antacid

2.

Contoh asid <i>Example of acid</i>	Formula molekul asid <i>Molecular formula of acid</i>	Kebesaran asid <i>Basicity of acid</i>	Persamaan penceraian asid di dalam air <i>Equation of dissociation of acid in water</i>
(a) Asid hidroklorik <i>Hydrochloric acid</i>	HCl	Monoprotik <i>Monoprotic</i>	$\text{HCl} \rightarrow \text{H}^+ + \text{Cl}^-$
(b) Asid fosforik <i>Phosphoric acid</i>	H_3PO_4	Triprotik <i>Triprotic</i>	$\text{H}_3\text{PO}_4 \rightarrow 3\text{H}^+ + \text{PO}_4^{3-}$
(c) Asid sulfurik <i>Sulphuric acid</i>	H_2SO_4	Diprotik <i>Diprotic</i>	$\text{H}_2\text{SO}_4 \rightarrow 2\text{H}^+ + \text{SO}_4^{2-}$

3. Keputusan / Result:

(a) Serbuk asid oksalik <i>Oxalic acid powder</i>	Warna biru kertas litmus kekal biru. <i>Colour of blue litmus paper remains blue.</i>
(b) Serbuk asid oksalik + air <i>Oxalic acid powder + water</i>	Warna biru kertas litmus berubah kepada merah. <i>Colour of blue litmus paper changes to red.</i>

Mentafsir data / Interpreting data:

- Warna kertas litmus biru bertukar kepada merah dalam keadaan berasid.
Colour of blue litmus paper changes to red in acidic condition.
- Asid menunjukkan sifat asid dalam kehadiran air.
Acid substances show acidic properties in the presence of water.

Perbincangan / Discussion:

- mengion, hidrogen
ionises, hydrogen
- molekul, mengion, hidrogen, hidrogen
molecule, ionise, hydrogen, hydrogen

4. Keputusan / Result:

(a) Pepejal natrium hidroksida <i>Solid sodium hydroxide</i>	Warna merah kertas litmus kekal merah. <i>Colour of red litmus paper remains red.</i>
(b) Pepejal natrium hidroksida + air <i>Solid sodium hydroxide + water</i>	Warna merah kertas litmus berubah kepada biru. <i>Colour of red litmus paper changes to blue.</i>

Mentafsir data / Interpreting data:

- Untuk mengesan kehadiran bahan alkali apabila kertas litmus merah menjadi biru.
To detect the presence of an alkali substance when the red litmus paper turns blue.
- Natrium hidroksida, NaOH tidak menunjukkan sifat kealkaliannya tanpa air kerana ion hidroksida, OH^- di dalam pepejal natrium hidroksida, NaOH tidak dapat bergerak bebas dan kekal terikat dalam struktur kekisinya.
Sodium hydroxide, NaOH does not show its alkaline properties without water because hydroxide ions, OH^- in solid sodium hydroxide, NaOH cannot move freely and are still bonded in its lattice structure.

Perbincangan / Discussion:

- kealkalian
alkaline
- mengion, hidroksida
ionises, hydroxide
- hidroksida
hydroxide
- kering
dry
- mengion
ionise

6.2 Nilai pH
pH Value

1. (a) Bahan kimia yang mengion di dalam air untuk menghasilkan ion hidrogen, H^+ .

Chemical substances that ionise in water to produce hydrogen ions, H^+ .

(b) (i) $-\log [X] = 2$
 $X = 10^{-2}$
 $X = 0.01 \text{ mol dm}^{-3}$

(ii) $pOH = -\log [0.01]$
 $pOH = 2$

$pH = 14 - pOH$

$pH = 14 - 2$

$pH = 12$

- (c) Nilai pH akan meningkat kerana penambahan air suling menurunkan kepekatan ion hidrogen di dalam bikar. Semakin rendah kepekatan ion hidrogen, semakin tinggi nilai pH.

The pH value will increase because the addition of distilled water decreases the concentration of hydrogen ions in the beaker. The lower the concentration of hydrogen ions, the higher the pH value.

2. Keputusan / Result:

(a) Kepekatan asid hidroklorik (mol dm^{-3}) <i>Concentration of hydrochloric acid (mol dm^{-3})</i>	0.10	0.010	0.0010
(b) Kepekatan ion hidrogen, H^+ (mol dm^{-3}) <i>Concentration of hydrogen ion, H^+ (mol dm^{-3})</i>	0.10	0.010	0.0010
(c) Nilai pH / pH value	1	2	3

Mentafsir data / Interpreting data:

- (a) bertambah / increases
 (b) berkurang / decreases
 (c) Semakin rendah kepekatan ion hidrogen, semakin tinggi nilai pH.
The lower the concentration of hydrogen ion, the higher the pH value.

Perbincangan / Discussion:

- (a) berkurang / decrease
 (b) berkurang / decrease
 (c) bertambah / increase
 (d) berkurang / decrease

3. Keputusan / Result:

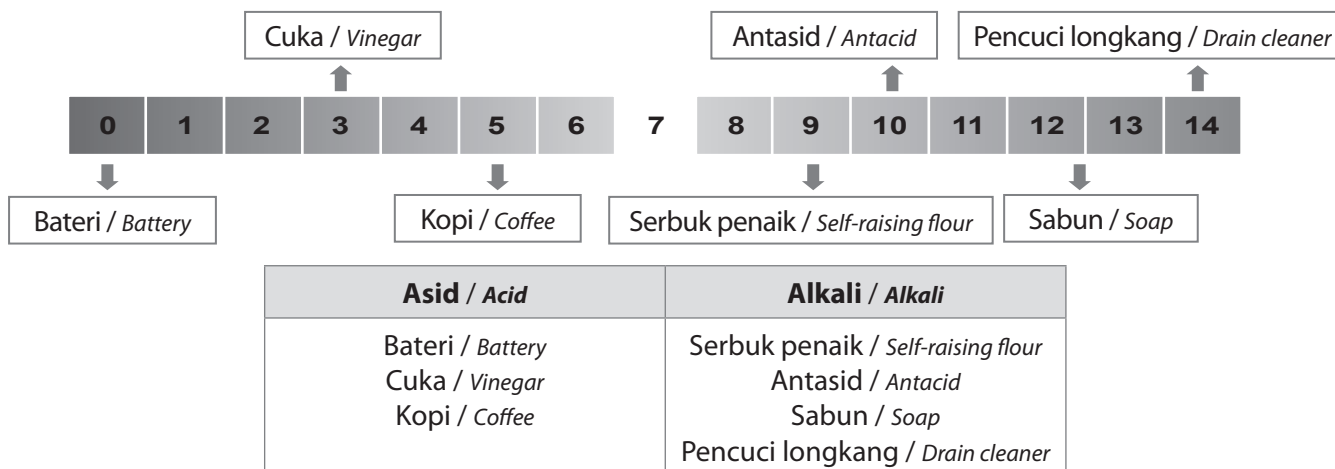
(a) Kepekatan larutan natrium hidroksida (mol dm^{-3}) <i>Concentration of sodium hydroxide solution (mol dm^{-3})</i>	0.10	0.010	0.0010
(b) Kepekatan ion hidroksida, OH^- (mol dm^{-3}) <i>Concentration of hydroxide ion, OH^- (mol dm^{-3})</i>	0.10	0.010	0.0010
(c) Nilai pH / pH value	13	12	11

Mentafsir data / Interpreting data:

- (a) berkurang / decreases
 (b) berkurang / decreases
 (c) Semakin rendah kepekatan ion hidroksida, semakin rendah nilai pH.
The lower the concentration of hydroxide ion, the lower the pH value.

Perbincangan / Discussion:

- (a) bertambah / increases
 (b) berkurang / decreases
 (c) bertambah / increases
 (d) bertambah / increases

4.


6.3 Kekuatan Asid dan Alkali
Strength of Acids and Alkalies

1. (a) Asid yang mengion sepenuhnya di dalam air menghasilkan kepekatan ion hidrogen yang tinggi.
Acid that ionises completely in water to produce high concentration of hydrogen ions.
- (b) Bikar A. Asid hidroklorik ialah asid kuat, manakala asid etanoik ialah asid lemah. Asid hidroklorik mengion sepenuhnya di dalam air menghasilkan kepekatan ion hidrogen yang tinggi, manakala asid etanoik mengion separa di dalam air menghasilkan kepekatan ion hidrogen yang rendah.
Beaker A. Hydrochloric acid is a strong acid, while ethanoic acid is a weak acid. Hydrochloric acid ionises completely in water to produce high concentration of hydrogen ions, while ethanoic acid ionises partially in water to produce low concentration of hydrogen ions.
- (c) Asid hidroklorik / *Hydrochloric acid*:
 $\text{HCl} \rightarrow \text{H}^+ + \text{Cl}^-$
Asid etanoik / *Ethanoic acid*:
 $\text{CH}_3\text{COOH} \rightleftharpoons \text{H}^+ + \text{CH}_3\text{COO}^-$
- (d) (i) $-\log [X] = 3$
 $X = 10^{-3}$
 $X = 0.001 \text{ mol dm}^{-3}$
(ii) $\text{pH} = -\log [0.001 \times 2]$
 $\text{pH} = 2.7$

2.

Sifat kimia <i>Chemical properties</i>	Tindak balas <i>Reaction</i>
(a) Asid <i>Acid</i>	Asid + bes \rightarrow <u>garam</u> + <u>air</u> / <i>Acid + base \rightarrow salt + water</i> Contoh / <i>Example</i> : $\text{H}_2\text{SO}_4 + \text{CuO} \rightarrow \text{CuSO}_4 + \text{H}_2\text{O}$
	Asid + logam reaktif \rightarrow <u>garam</u> + <u>gas hidrogen</u> / <i>Acid + reactive metal \rightarrow salt + hydrogen gas</i> Contoh / <i>Example</i> : $\text{H}_2\text{SO}_4 + \text{Zn} \rightarrow \text{ZnSO}_4 + \text{H}_2$
	Asid + karbonat logam \rightarrow <u>garam</u> + <u>air</u> + <u>gas karbon dioksida</u> <i>Acid + metal carbonate \rightarrow salt + water + carbon dioxide gas</i> Contoh / <i>Example</i> : $2\text{HNO}_3 + \text{CaCO}_3 \rightarrow \text{Ca(NO}_3)_2 + \text{H}_2\text{O} + \text{CO}_2$

6.4 Sifat-sifat Kimia Asid dan Alkali
Chemical Properties of Acids and Alkalies

1. (a) P: Zink / *Zinc*
Q: Hidrogen / *Hydrogen*
R: Air / *Water*
S: Karbon dioksida / *Carbon dioxide*
- (b) Tindak balas I / *Reaction I*:
 $\text{Zn} + 2\text{HNO}_3 \rightarrow \text{Zn(NO}_3)_2 + \text{H}_2$
Tindak balas II / *Reaction II*:
 $\text{NaOH} + \text{HNO}_3 \rightarrow \text{NaNO}_3 + \text{H}_2\text{O}$
Tindak balas III / *Reaction III*:
 $\text{CaCO}_3 + 2\text{HNO}_3 \rightarrow \text{Ca(NO}_3)_2 + \text{H}_2\text{O} + \text{CO}_2$
- (c) Bilangan mol gas S / *Number of moles of gas S*
$$= \frac{1200}{24000}$$

$$= 0.05 \text{ mol}$$

1 mol CaCO_3 menghasilkan 1 mol gas S.
Maka, 0.05 mol CaCO_3 menghasilkan 0.05 mol gas S.
*1 mole of CaCO_3 produces 1 mole of gas S.
Thus, 0.05 mole of CaCO_3 produces 0.05 mole of gas S.*
Jisim CaCO_3 / *Mass of CaCO_3*
$$= 0.05 \times [40 + 12 + (16 \times 3)]$$

$$= 0.05 \times 100$$

$$= 5 \text{ g}$$

Sifat kimia Chemical properties	Tindak balas Reaction
(b) Alkali Alkali	Alkali + asid → <u>garam</u> + <u>air</u> / Alkali + acid → <u>salt</u> + <u>water</u> Contoh / Example: $\text{NaOH} + \text{C}_6\text{H}_5\text{COOH} \rightarrow \text{C}_6\text{H}_5\text{COONa} + \text{H}_2\text{O}$
	Alkali + garam ammonium → <u>garam</u> + <u>air</u> + <u>gas ammonia</u> Alkali + ammonium salt → <u>salt</u> + <u>water</u> + <u>ammonia gas</u> Contoh / Example: $\text{NaOH} + \text{NH}_4\text{Cl} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{NH}_3$
	Alkali + ion logam → <u>hidroksida logam tak larut</u> + <u>kation daripada alkali</u> Alkali + metal ion → <u>insoluble metal hydroxide</u> + <u>cation from alkali</u> Contoh / Example: $2\text{NaOH} + \text{Fe}^{2+} \rightarrow \text{Fe}(\text{OH})_2 + 2\text{Na}^+$

6.5 Kepekatan Larutan Akueus Concentration of Aqueous Solution

- $\frac{\text{gram}}{\text{dm}^3}$
 - $\frac{\text{mol}}{\text{dm}^3}$
- Asid hidroklorik adalah asid kuat yang mengion sepenuhnya di dalam air.
Hydrochloric acid is a strong acid that ionises completely in water.
 - 1 mol HCl menghasilkan 1 mol ion Cl^- .
1 mol of HCl produces 1 mol of Cl^- ions.
 - Kepekatan awal ion Cl^- di dalam bikar = Kepekatan asid HCl = 0.50 mol dm^{-3} .
Initial concentration of Cl^- ions in a beaker = Concentration of HCl acid = 0.50 mol dm^{-3} .
 - Bilangan mol ion Cl^- di dalam bikar
The number of moles of Cl^- ions in a beaker:
 = kemolaran larutan \times isi padu larutan
molarity of solution \times volume of solution
 = $0.50 \text{ mol dm}^{-3} \times 2.0 \text{ dm}^3$
 = 1.0 mol

 Jisim molar AlCl_3 / *Molar mass of AlCl_3*
 = $27 + 3(35.5) = 133.5 \text{ g mol}^{-1}$

 Bilangan mol AlCl_3 / *Number of moles of AlCl_3*
 = $\frac{26.7}{133.5}$
 = 0.20 mol

 1 mol $\text{AlCl}_3 = 3 \text{ mol ion Cl}^-$
1 mol of $\text{AlCl}_3 = 3 \text{ mol of Cl}^-$ ions

Bilangan mol ion Cl^- ditambahkan

Number of moles of Cl^- ions added

$$= 3 \times 0.2 \text{ mol} = 0.60 \text{ mol}$$

Jumlah bilangan mol ion Cl^- di dalam bikar

Total number of moles of Cl^- in a beaker

$$= (\text{bilangan mol } \text{Cl}^- \text{ daripada HCl}) + (\text{bilangan mol } \text{Cl}^- \text{ daripada } \text{AlCl}_3)$$

(number of moles of Cl^- from HCl) + (number of moles of Cl^- from AlCl_3)

$$= 1.0 \text{ mol} + 0.60 \text{ mol}$$

$$= 1.6 \text{ mol}$$

Kepekatan akhir ion Cl^-

Final concentration of Cl^- ions

$$= \frac{1.6 \text{ mol}}{2.0 \text{ dm}^3}$$

$$= 0.80 \text{ mol dm}^{-3}$$

Maka, kepekatan ion Cl^- bertambah daripada 0.50 mol dm^{-3} kepada 0.80 mol dm^{-3} .

Hence, the concentration of Cl^- ions increases from 0.50 mol dm^{-3} to 0.80 mol dm^{-3} .

Kepekatan ion Cl^- bertambah sebanyak:

The concentration of Cl^- ions increases by:

$$= \frac{0.8 - 0.50}{0.50} \times 100\%$$

$$= 60\%$$

6.6 Larutan Piawai Standard Solution

- Bilangan mol zat terlarut dan isi padu larutan diketahui dengan tepat.
Number of moles of solute and volume of solution is accurately known.

- Jisim zat terlarut dan isi padu larutan diketahui dengan tepat.
Mass of solute and volume of solution is accurately known.

2. (a) 4 (b) 1 (c) 6 (d) 3 (e) 5
(f) 2

3. (a) Larutan yang kepekannya diketahui dengan tepat.

Solution with known concentration.

- (b) Bilangan mol natrium hidroksida / *Number of moles of sodium hydroxide*

$$= \frac{1 \times 250}{1000}$$

$$= 0.25 \text{ mol}$$

Jisim natrium hidroksida / *Mass of sodium hydroxide*

$$= 0.25 \times (23 + 1 + 16)$$

$$= 10 \text{ g}$$

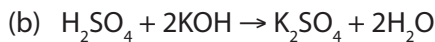
- (c) (i) Pencairan / *Dilution*

(ii) $M_1 V_1 = M_2 V_2$
 $1 \times 10 = M_2 \times 250$
 $M_2 = 0.04 \text{ mol dm}^{-3}$

(iii) $= 0.04 \times (23 + 1 + 16)$
 $= 0.04 \times 40$
 $= 1.6 \text{ g dm}^{-3}$

6.7 Peneutralan *Neutralisation*

1. (a) (i) Peneutralan / *Neutralisation*
 (ii) Merah jambu kepada tidak berwarna /
Pink to colourless



(c) (i) $= \frac{22.6 + 22.4 + 22.5}{3}$
 $= 22.5 \text{ cm}^3$

(ii) $\frac{M_a V_a}{M_b V_b} = \frac{a}{b}$

$$\frac{1 \times 22.5}{M_b \times 25.0} = \frac{1}{2}$$

$$M_b = 1.8 \text{ mol dm}^{-3}$$

Garam, Hablur dan Kegunaan dalam Kehidupan

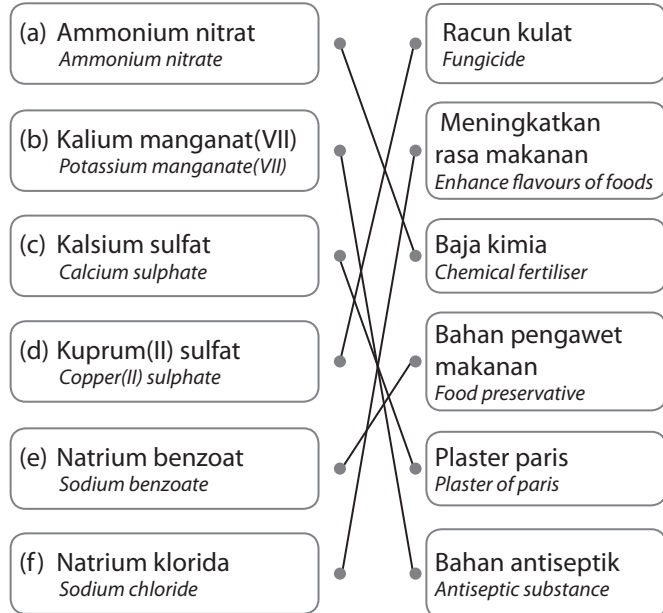
6.8 Salts, Crystals and Their Uses in Daily Life

1. ion, hidrogen, ammonium
an ionic, hydrogen, ammonium

2. (a) tajam
Sharp

- (b) Sudut
angle
 (c) tertentu
Specific
 (d) rata
Flat
 (e) tajam
Sharp
 (f) berbeza
different
 (g) Saiz hablur
Size of crystal

3.



6.9 Penyediaan Garam *Preparation of Salts*

1. (a) (i) nitrat
nitrate
 (ii) natrium
sodium
 (iii) kalium
potassium
 (iv) ammonium
ammonium
 (v) karbonat
carbonate
 (vi) • Argentum klorida, AgCl
Silver chloride, AgCl
 • Plumbum(II) klorida, PbCl₂
Lead(II) chloride, PbCl₂
 • Merkuri(I) klorida, Hg₂Cl₂
Mercury(I) chloride, Hg₂Cl₂
 (vii) • Barium sulfat, BaSO₄
Barium sulphate, BaSO₄

- Plumbum(II) sulfat, PbSO_4
Lead(II) sulphate, PbSO_4
 - Kalsium sulfat, CaSO_4
Calcium sulphate, CaSO_4
- (b) Plumbum(II) klorida, PbCl_2 dan plumbum(II) iodida, PbI_2
Lead(II) chloride, PbCl_2 and lead(II) iodide, PbI_2
2. peneutralan / neutralisation
garam + air / salt + water
3. (a) Asid hidroklorik / *Hydrochloric acid*
(b) Natrium hidroksida / *Sodium hydroxide*
(c) Asid sulfurik / *Sulphuric acid*
(d) Kalium hidroksida / *Kalium hidroksida*
(e) Asid nitrik / *Nitric acid*
(f) Ammonia / *Ammonia*
4. (a) Peneutralan / *Neutralisation*
(b) Menentukan takat akhir pentitratan
To determine the end-point of the titration
(c) bahan penunjuk / *the indicator*
(d) penguraian terma / *thermal decomposition*
(e) Garam ammonium dan garam natrium
Ammonium salts and sodium salts
(f) $2\text{KOH} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2\text{H}_2\text{O}$
 $2\text{KOH} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2\text{H}_2\text{O}$
5. (a) Garam / *Salt*
(b) Air / *Water*
(c) Garam / *Salt*
(d) Hidrogen / *Hydrogen*
(e) Garam / *Salt*
(f) Air / *Water*
(g) Karbon dioksida / *Carbon dioxide*
6. (a) 6 (b) 1 (c) 3 (d) 2 (e) 4 (f) 5
7. (a) Untuk mempercepat tindak balas asid sulfurik dengan zink
To increase the rate of reaction between sulphuric acid and zinc
(b) asid sulfurik telah bertindak balas sepenuhnya.
sulphuric acid is reacted completely
(c) $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2\text{O}$
8. (a) Asid nitrik yang tidak bertindak balas tidak dapat disingkirkan melalui penurasan.
The unreacted nitric acid cannot be removed by filtration.
(b) Ya. Magnesium oksida merupakan bes. Asid nitrik meneutralkan magnesium oksida untuk menghasilkan hanya garam dan air.
Yes. Magnesium oxide is a base. Nitric acid neutralises magnesium oxide to produce only salt and water.
(c) $\text{MgO} + 2\text{HNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + \text{H}_2\text{O}$
9. (a) Karbon dioksida. Gas yang terhasil dialirkan ke dalam air kapur. Air kapur menjadi keruh.
Carbon dioxide. The gas produced is flowed into limewater. Limewater turns cloudy.
(b) $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
10. (b) ✓ (c) ✓
11. (d) ✓ (e) ✓
12. (a) (i) 1 (iv) 3
(ii) 5 (iv) 4
(iii) 2
(b) Plumbum(II) nitrat, kalium iodida / *Lead(II) nitrate, potassium iodide / $\text{Pb}(\text{NO}_3)_2$, KI*
(c) Plumbum(II) iodida ialah garam tak terlarutkan.
Lead(II) iodide is an insoluble salt.
(d) $\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \rightarrow \text{PbI}_2 + 2\text{KNO}_3$
13. (a) K^+ , NO_3^-
(b) (iii) ✓
(c) $\text{Ag}^+ + \text{Cl}^- \rightarrow \text{AgCl}$
14. (a) perubahan berterusan / *continuous variation*
(b) bertambah, malar / *higher, fixed*
(c) (i) Isi padu larutan kalium klorida
Volume of potassium chloride solution
(ii) Ketinggian mendakan terbentuk
Height of precipitate formed
(iii) Isi padu dan kepekatan larutan plumbum(II) nitrat dan kepekatan larutan kalium klorida
Volume and concentration of lead(II) nitrate solution and concentration of potassium chloride solution
(e) 5 cm^3
(f) 5.0 cm^3 , 5.0 cm^3
- Bilangan mol $\text{Pb}(\text{NO}_3)_2$ bertindak balas
Number of moles of $\text{Pb}(\text{NO}_3)_2$ reacted:
$$= \frac{0.5 \times 5}{1000}$$

$$= 0.0025 \text{ mol}$$

Bilangan mol KCl bertindak balas:
Number of moles of KCl reacted:
$$= \frac{1.0 \times 5}{1000}$$

$$= 0.0050 \text{ mol}$$

$$0.0025 : 0.0050 = 1 : 2$$

1, 2
$$\text{Pb}^{2+} + 2\text{Cl}^- \rightarrow \text{PbCl}_2$$

- (g) Ketinggian mendakan dapat dihubungkan dengan kuantiti (bilangan mol) mendakan yang terhasil.

The height of the precipitate can be related to the quantity (number of moles) of precipitate formed.

- (h) Semakin banyak plumbum(II) nitrat bertindak balas dengan kalium klorida, semakin tinggi mendakan yang terbentuk.

The more lead(II) nitrate reacts with potassium chloride, the higher the height of the precipitate formed.

- (i) Semua plumbum(II) nitrat telah bertindak balas lengkap dengan kalium klorida.
All the lead(II) nitrate has reacted completely with potassium chloride.

6.10 Tindakan Haba ke atas Garam
Effect of Heat on Salts

1.

Ujian gas / Gas test	Kaedah / Method	Pemerhatian / Observation
(a) Gas oksigen, O ₂ <i>Oxygen gas, O₂</i>	Masukkan kayu uji tabung uji berisi. <i>Insert a glowing wooden splinter into the test tube containing the gas.</i>	Gas menyalakan semula kayu uji berbara. <i>Gas rekindles the glowing wooden splinter.</i>
(b) Gas hidrogen, H ₂ <i>Hydrogen gas, H₂</i>	Masukkan kayu uji bernyala ke dalam tabung uji berisi gas. <i>Insert a lighted wooden splinter into the test tube containing the gas.</i>	Gas terbakar dengan bunyi 'pop'. <i>Gas burns with a 'pop' sound.</i>
(c) Gas karbon dioksida, CO ₂ <i>Carbon dioxide gas, CO₂</i>	Salurkan gas ke dalam air kapur. <i>Flow the gas into limewater.</i>	Gas mengeruhkan air kapur. <i>Gas turns limewater cloudy.</i>
(d) Gas ammonia, NH ₃ <i>Ammonia gas, NH₃</i>	Dekatkan kertas litmus merah lembap ke dalam tabung uji berisi gas. <i>Bring a moist red litmus paper into the test tube containing the gas.</i>	<ul style="list-style-type: none"> Gas berbau sengit terhasil. <i>Gas with a pungent smell is produced.</i> Gas menukarkan kertas litmus merah kepada biru. <i>Gas turns moist red litmus paper blue.</i>
(e) Gas klorin, Cl ₂ <i>Chlorine gas, Cl₂</i>	Dekatkan kertas litmus biru lembap ke dalam tabung uji berisi gas. <i>Bring a moist blue litmus paper into the test tube containing the gas.</i>	<ul style="list-style-type: none"> Gas berwarna kuning kehijauan dan berbau sengit terhasil. <i>Greenish yellow gas with a pungent smell is produced.</i> Gas menukarkan kertas litmus biru kepada merah dan kemudian melunturkannya. <i>Gas turns moist blue litmus paper red and finally decolourises it.</i>
(f) Gas hidrogen klorida, HCl <i>Hydrogen chloride gas, HCl</i>	Dekatkan setitis larutan ammonia pekat pada hujung rod kaca ke dalam tabung uji berisi gas. <i>Bring a drop of concentrated ammonia solution on the end of a glass rod into the test tube containing the gas.</i>	Gas membentuk wasap putih. <i>Gas forms white fumes.</i>
(g) Gas sulfur dioksida, SO ₂ <i>Sulphur dioxide gas, SO₂</i>	Salurkan gas ke dalam larutan kalium manganat(VII) berasid. <i>Flow the gas into acidified potassium manganate(VII) solution.</i>	Gas melunturkan warna ungu larutan kalium manganat(VII). <i>Gas decolourises purple potassium manganate(VII) solution.</i>
(h) Nitrogen dioksida, NO ₂ <i>Nitrogen dioxide, NO₂</i>	Dekatkan kertas litmus biru lembap ke dalam tabung uji berisi gas. <i>Bring a moist blue litmus paper into the test tube containing the gas.</i>	<ul style="list-style-type: none"> Gas berwarna perang dan berbau sengit terhasil. <i>Brown gas with a pungent smell is produced.</i> Gas menukarkan kertas litmus biru lembap kepada merah. <i>Gas turns moist blue litmus paper turns red.</i>

2. (a) (i) Karbon dioksida
Carbon dioxide
- (ii) Plumbum(II) karbonat / *Lead(II) carbonate* / PbCO_3
- (iii) $\text{PbCO}_3 \rightarrow \text{PbO} + \text{CO}_2$
- (b) Jenis garam:
Type of salt:
Garam tak terlarutkan
Insoluble salt
Tindak balas:
Reaction:
Pemendakan / Penguraian ganda dua
Precipitation / Double decomposition reaction
- (c) • Natrium karbonat / kalium karbonat / ammonium karbonat / Na_2CO_3 / K_2CO_3 / $(\text{NH}_4)_2\text{CO}_3$
Sodium carbonate / potassium carbonate / ammonium carbonate / Na_2CO_3 / K_2CO_3 / $(\text{NH}_4)_2\text{CO}_3$
- Plumbum(II) nitrat / *Lead(II) nitrate* / $\text{Pb}(\text{NO}_3)_2$
- (d) (i) Kuning apabila panas dan putih apabila sejuk
Yellow when hot and white when cool
- (ii) $\text{ZnCO}_3 \rightarrow \text{ZnO} + \text{CO}_2$
- (e) Kalium karbonat, natrium karbonat
Potassium carbonate, sodium carbonate

3. Keputusan / Result:

Garam karbonat <i>Carbonate salt</i>	Warna garam karbonat sebelum dipanaskan <i>Colour of carbonate salt before heating</i>	Warna baki <i>Colour of residue</i>		Air kapur <i>Limewater</i>
		Panas <i>Hot</i>	Sejuk <i>Cold</i>	
(a) Kalsium karbonat <i>Calcium carbonate</i>	Putih <i>White</i>	Putih <i>White</i>	Putih <i>White</i>	Air kapur menjadi keruh <i>Limewater turns cloudy</i>
(b) Kuprum(II) karbonat <i>Copper(II) carbonate</i>	Hijau <i>Green</i>	Hitam <i>Black</i>	Hitam <i>Black</i>	Air kapur menjadi keruh <i>Limewater turns cloudy</i>
(c) Magnesium karbonat <i>Magnesium carbonate</i>	Putih <i>White</i>	Putih <i>White</i>	Putih <i>White</i>	Air kapur menjadi keruh <i>Limewater turns cloudy</i>
(d) Plumbum(II) karbonat <i>Lead(II) carbonate</i>	Putih <i>White</i>	Perang <i>Brown</i>	Kuning <i>Yellow</i>	Air kapur menjadi keruh <i>Limewater turns cloudy</i>
(e) Zink karbonat <i>Zinc carbonate</i>	Putih <i>White</i>	Kuning <i>Yellow</i>	Putih <i>White</i>	Air kapur menjadi keruh <i>Limewater turns cloudy</i>
(f) Natrium karbonat <i>Sodium carbonate</i>	Putih <i>White</i>	–	–	Tiada perubahan <i>No change</i>
(g) Kalium karbonat <i>Potassium carbonate</i>	Putih <i>White</i>	–	–	Tiada perubahan <i>No change</i>

Mentafsir data / Interpreting data:

- (a) terurai
decompose
- (b) karbon dioksida, mengeruhkan
carbon dioxide, cloudy

Perbincangan / Discussion:

- (a) logam oksida, karbon dioksida
metal oxide, carbon dioxide
- (b) • Logam alkali ialah logam yang sangat reaktif yang membentuk sebatian karbonat yang sangat stabil.
Alkali metals are very reactive which form very stable carbonate compounds.
- Penguraian karbonat berlaku pada suhu yang sangat tinggi.
Decomposition of these carbonates occurs at very high temperatures.

4. Keputusan / Result:

Garam nitrat <i>Nitrate salt</i>	Warna nitrat sebelum dipanas <i>Colour of nitrate before heating</i>	Warna baki <i>Colour of residue</i>		Warna gas <i>Colour of gas</i>	Kertas litmus biru lembap <i>Moist blue litmus paper</i>	Kayu uji berbara <i>Glowing wooden splinter</i>
		Panas <i>Hot</i>	Sejuk <i>Cold</i>			
(a) Kalsium nitrat <i>Calcium nitrate</i>	Putih <i>White</i>	Putih <i>White</i>	Putih <i>White</i>	Perang <i>Brown</i>	Biru bertukar kepada merah <i>Blue turns red</i>	Menyala semula <i>Rekindles</i>
(b) Kuprum(II) nitrat <i>Copper(II) nitrate</i>	Hijau <i>Green</i>	Hitam <i>Black</i>	Hitam <i>Black</i>	Perang <i>Brown</i>	Biru bertukar kepada merah <i>Blue turns red</i>	Menyala semula <i>Rekindles</i>
(c) Magnesium nitrat <i>Magnesium nitrate</i>	Putih <i>White</i>	Putih <i>White</i>	Putih <i>White</i>	Perang <i>Brown</i>	Biru bertukar kepada merah <i>Blue turns red</i>	Menyala semula <i>Rekindles</i>
(d) Plumbum(II) nitrat <i>Lead(II) nitrate</i>	Putih <i>White</i>	Perang <i>Brown</i>	Kuning <i>Yellow</i>	Perang <i>Brown</i>	Biru bertukar kepada merah <i>Blue turns red</i>	Menyala semula <i>Rekindles</i>
(e) Zink nitrat <i>Zinc carbonate</i>	Putih <i>White</i>	Kuning <i>Yellow</i>	Putih <i>White</i>	Perang <i>Brown</i>	Biru bertukar kepada merah <i>Blue turns red</i>	Menyala semula <i>Rekindles</i>
(f) Natrium nitrat <i>Sodium nitrate</i>	Putih <i>White</i>	Putih <i>White</i>	Putih <i>White</i>	Tidak berwarna <i>Colourless</i>	Kekal biru <i>Remains blue</i>	Menyala semula <i>Rekindles</i>
(g) Kalium nitrat <i>Potassium nitrate</i>	Putih <i>White</i>	Putih <i>White</i>	Putih <i>White</i>	Tidak berwarna <i>Colourless</i>	Kekal biru <i>Remains blue</i>	Menyala semula <i>Rekindles</i>

Mentafsir data / Interpreting data:

- (a) terurai
decompose
- (b) nitrogen dioksida, oksigen
nitrogen dioxide, oxygen

Perbincangan / Discussion:

- (a) oksida logam, nitrogen dioksida, oksigen
metal oxide, nitrogen dioxide, oxygen
- (b) $2\text{NaNO}_3 \rightarrow 2\text{NaNO}_2 + \text{O}_2$
 $2\text{NaNO}_3 \rightarrow 2\text{NaNO}_2 + \text{O}_2$

5. W: $\text{Zn}(\text{NO}_3)_2$
X: ZnO
Y: ZnCO_3
Z: CO_2

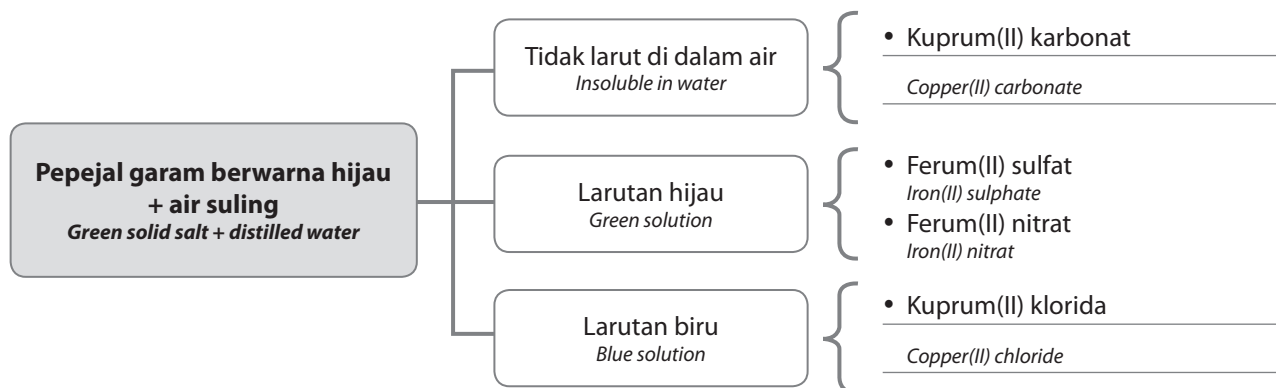
6.11 Analisis Kualitatif
Qualitative Analysis

1. (a) 3 (b) 1 (c) 2 (d) 4

2.

Garam Salt	Warna pepejal garam Colour of solid salt	Keterlarutan di dalam air Solubility in water	Warna larutan garam Colour of salt solution
(a) Ammonium nitrat <i>Ammonium nitrate</i>	Putih <i>White</i>	Larut <i>Soluble</i>	Tidak berwarna <i>Colourless</i>
(b) Natrium klorida <i>Sodium chloride</i>	Putih <i>White</i>	Larut <i>Soluble</i>	Tidak berwarna <i>Colourless</i>
(c) Kalium nitrat <i>Potassium nitrate</i>	Putih <i>White</i>	Larut <i>Soluble</i>	Tidak berwarna <i>Colourless</i>
(d) Kalsium karbonat <i>Calcium carbonate</i>	Putih <i>White</i>	Tidak larut <i>Insoluble</i>	–
(e) Magnesium sulfat <i>Magnesium sulphate</i>	Putih <i>White</i>	Larut <i>Soluble</i>	Tidak berwarna <i>Colourless</i>
(f) Kuprum(II) karbonat <i>Copper(II) carbonate</i>	Hijau <i>Green</i>	Tidak larut <i>Insoluble</i>	–
(g) Zink sulfat <i>Zinc sulphate</i>	Putih <i>White</i>	Larut <i>Soluble</i>	Tidak berwarna <i>Colourless</i>
(h) Ferum(II) sulfat <i>Iron(II) sulphate</i>	Hijau <i>Green</i>	Larut <i>Soluble</i>	Hijau <i>Green</i>
(i) Ferum(II) nitrat <i>Iron(II) nitrate</i>	Hijau <i>Green</i>	Larut <i>Soluble</i>	Hijau <i>Green</i>
(j) Ferum(III) klorida <i>Iron(III) chloride</i>	Perang <i>Brown</i>	Larut <i>Soluble</i>	Perang <i>Brown</i>
(k) Ferum(III) sulfat <i>Iron(III) sulphate</i>	Perang <i>Brown</i>	Larut <i>Soluble</i>	Perang <i>Brown</i>
(l) Plumbum(II) nitrat <i>Lead(II) nitrate</i>	Putih <i>White</i>	Larut <i>Soluble</i>	Tidak berwarna <i>Colourless</i>
(m) Kuprum(II) sulfat <i>Copper(II) sulphate</i>	Biru <i>Blue</i>	Larut <i>Soluble</i>	Biru <i>Blue</i>
(n) Kuprum(II) klorida <i>Copper(II) chloride</i>	Hijau <i>Green</i>	Larut <i>Soluble</i>	Biru <i>Blue</i>

3.



4. Tidak benar. Warna sahaja tidak mengesahkan identiti sesuatu kation kerana warna bukan ciri unik bagi kation. Terdapat beberapa kation mempunyai warna yang sama. Contoh: ion Fe^{2+} , Cr^{3+} dan Ni^{2+} berwarna hijau.

Not true. Colour alone cannot identify a particular cation because colour is not a unique property of a cation. There are a few cations that have the same colour. Example: Fe^{2+} , Cr^{3+} and Ni^{2+} ions are green.

5.

Ujian anion / Anion test	Pemerhatian / Observation	Inferens / Inference
(a) Ion karbonat, CO_3^{2-} <i>Carbonate ion, CO_3^{2-}</i>	<ul style="list-style-type: none"> Pembuakan berlaku <i>Effervescence occurs</i> Mengeruhkan air kapur <i>Turns limewater cloudy</i> 	$2\text{H}^+(\text{ak}) + \text{CO}_3^{2-}(\text{ak}) \rightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{ce})$ $2\text{H}^+(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
(b) Ion klorida, Cl^- <i>Chloride ion, Cl^-</i>	<ul style="list-style-type: none"> Mendakan putih terbentuk <i>White precipitate is formed</i> 	$\text{Ag}^+(\text{ak}) + \text{Cl}^-(\text{ak}) \rightarrow \text{AgCl}(\text{p})$ $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$
(c) Ion sulfat, SO_4^{2-} <i>Sulphate ion, SO_4^{2-}</i>	<ul style="list-style-type: none"> Mendakan putih terbentuk <i>White precipitate is formed</i> 	$\text{Ba}^{2+}(\text{ak}) + \text{SO}_4^{2-}(\text{ak}) \rightarrow \text{BaSO}_4(\text{p})$ $\text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{BaSO}_4(\text{s})$
(d) Ion nitrat, NO_3^- <i>Nitrate ion, NO_3^-</i>	<ul style="list-style-type: none"> Cincin perang terbentuk <i>Brown ring is formed</i> 	

Mentafsir data / Interpreting data:

- (a) mendakan putih
white precipitate
- (b) karbon dioksida, air kapur
carbon dioxide, limewater
- (c) mendakan putih, barium klorida, barium nitrat
white precipitate, barium chloride, barium nitrate
- (d) cincin perang
brown ring

Perbincangan / Discussion:

- (a) Ion klorida bergabung dengan ion argenterum untuk membentuk mendakan putih argenterum klorida yang tidak larut di dalam air. *Chloride ion combines with silver ion to form a white precipitate of silver chloride that is insoluble in water.*
- (b) bertindak balas dan menyingkirkan ion karbonat yang mungkin hadir *react and remove the carbonate ion that may be present*

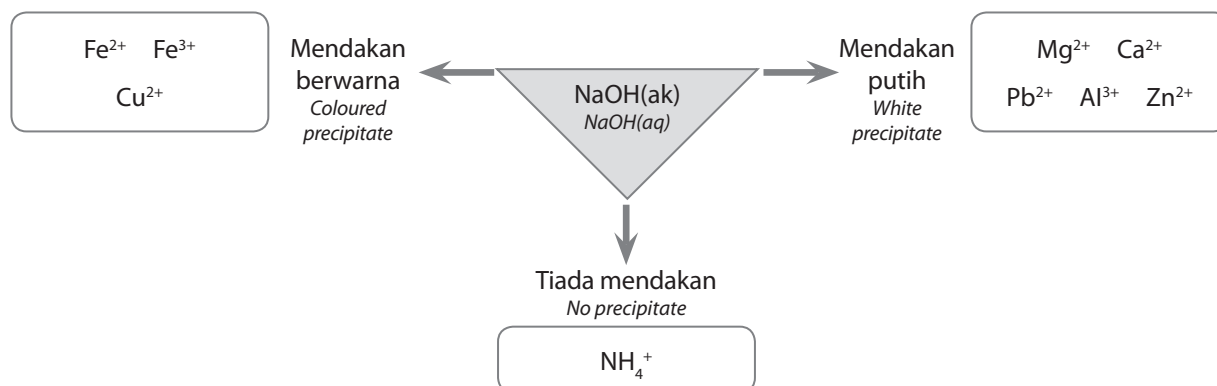
6. Keputusan / Result:

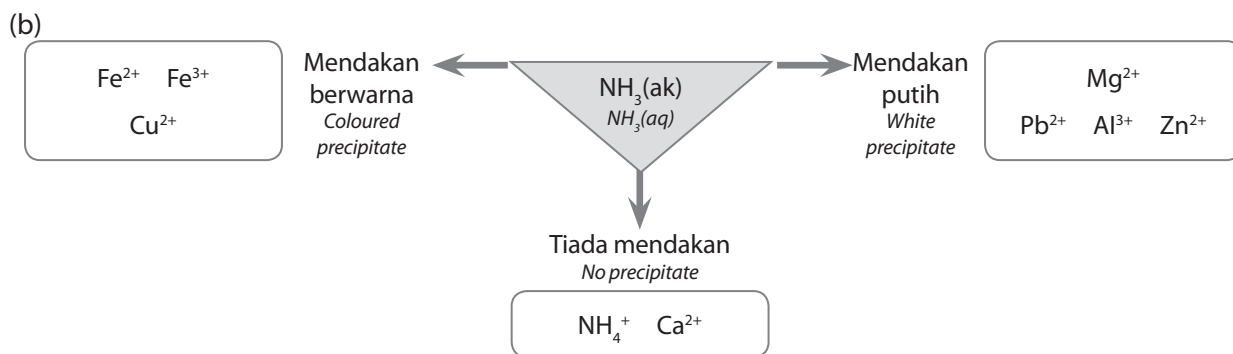
Kation Cation	Pemerhatian Observation			
	NaOH(ak) NaOH(aq)	NaOH(ak) berlebihan Excess NaOH(aq)	NH ₃ (ak) NH ₃ (aq)	NH ₃ (ak) berlebihan Excess NH ₃ (aq)
(a) NH_4^+	<ul style="list-style-type: none"> Tiada mendakan <i>No precipitate</i> Gas terbebas apabila dipanaskan <i>Gas is released when heated</i> Gas menukarkan kertas litmus merah lembap kepada biru <i>Gas turns moist red litmus paper to blue</i> 	-	Tiada mendakan <i>No precipitate</i>	-
(b) Mg^{2+}	Mendakan putih <i>White precipitate</i>	Mendakan tidak larut di dalam alkali berlebihan <i>Precipitate is insoluble in excess alkali</i>	Tiada mendakan <i>No precipitate</i>	-

(c) Ca^{2+}	Mendakan putih <i>White precipitate</i>	Mendakan tidak larut di dalam alkali berlebihan <i>Precipitate is insoluble in excess alkali</i>	Mendakan putih <i>White precipitate</i>	Mendakan tidak larut di dalam alkali berlebihan <i>Precipitate is insoluble in excess alkali</i>
(d) Pb^{2+}	Mendakan putih <i>White precipitate</i>	Mendakan larut di dalam alkali berlebihan membentuk larutan tidak berwarna <i>Precipitate is soluble in excess alkali forming colourless solution</i>	Mendakan putih <i>White precipitate</i>	Mendakan tidak larut di dalam alkali berlebihan <i>Precipitate is insoluble in excess alkali</i>
(e) Al^{3+}	Mendakan putih <i>White precipitate</i>	Mendakan larut di dalam alkali berlebihan membentuk larutan tidak berwarna <i>Precipitate is soluble in excess alkali forming colourless solution</i>	Mendakan putih <i>White precipitate</i>	Mendakan tidak larut di dalam alkali berlebihan <i>Precipitate is insoluble in excess alkali</i>
(f) Zn^{2+}	Mendakan putih <i>White precipitate</i>	Mendakan larut di dalam alkali berlebihan membentuk larutan tidak berwarna <i>Precipitate is soluble in excess alkali forming colourless solution</i>	Mendakan putih <i>White precipitate</i>	Mendakan larut di dalam alkali berlebihan membentuk larutan tidak berwarna <i>Precipitate is soluble in excess alkali forming colourless solution</i>
(g) Fe^{2+}	Mendakan hijau <i>Green precipitate</i>	Mendakan tidak larut di dalam alkali berlebihan <i>Precipitate is insoluble in excess alkali</i>	Mendakan hijau <i>Green precipitate</i>	Mendakan tidak larut di dalam alkali berlebihan <i>Precipitate is insoluble in excess alkali</i>
(h) Fe^{3+}	Mendakan perang <i>Brown precipitate</i>	Mendakan tidak larut di dalam alkali berlebihan <i>Precipitate is insoluble in excess alkali</i>	Mendakan perang <i>Brown precipitate</i>	Mendakan tidak larut di dalam alkali berlebihan <i>Precipitate is insoluble in excess alkali</i>
(i) Cu^{2+}	Mendakan biru <i>Blue precipitate</i>	Mendakan tidak larut di dalam alkali berlebihan <i>Precipitate is insoluble in excess alkali</i>	Mendakan biru <i>Blue precipitate</i>	Mendakan larut di dalam alkali berlebihan membentuk larutan biru tua <i>Precipitate is soluble in excess alkali forming dark blue solution</i>

Mentafsir data / Analysing data::

(a)





- (c) (i) Pb^{2+} , Al^{3+} , Zn^{2+}
 (ii) Cu^{2+} , Zn^{2+}
 (iii) Zn^{2+}
- (d) (i) Fe^{2+}
 (ii) Fe^{3+}
 (iii) Cu^{2+}

Perbincangan / Discussion:

- (a) air, ion hidroksida, hidroksida logam
water, hydroxide ions, metal hydroxides
 hidroksida logam
metal hydroxide
- (b) berwarna
coloured
- (c) putih
white

7.

Kation Cation	Pemerhatian Observation
(a) NH_4^+	Mendakan perang <i>Brown precipitate</i>
(b) Fe^{2+}	Mendakan biru tua <i>Dark blue precipitate</i>

Kation Cation	Pemerhatian Observation
(c) Fe^{3+}	Larutan kalium heksasianoferat(II): <i>Potassium hexacyanoferrate(II) solution:</i> Mendakan biru tua <i>Dark blue precipitate</i> Larutan kalium tiosianat: <i>Potassium thiocyanate solution:</i> Larutan berwarna merah darah <i>Blood red solution</i>
(d) Pb^{2+}	Mendakan kuning larut di dalam air panas dan termendak semula apabila disejukkan. <i>Yellow precipitate dissolves in hot water and reprecipitated when cooled.</i>

Mentafsir data / Analysing data:

- (a) reagen Nessler / *Nessler reagent*
 (b) hijau, biru tua / *green, dark blue*
 (c) perang, biru tua / *brown, dark blue*
 (d) kuning, kalium iodida
yellow, potassium iodide

Perbincangan / Discussion:

- (a) iodida, kalium iodida, kuning, PbI_2
iodide, potassium iodide, yellow, PbI_2
 (b) tiada mendakan / *no precipitate*
 (c) ammonia, merah, biru, hidrogen klorida
ammonia, red, blue, hydrogen chloride

8.

Ujian / Test	Pemerhatian / Observation	Inferens / Inference
Masukkan dua spatula pepejal U ke dalam sebuah bikar. <i>Place two spatula of solid U into a beaker.</i>	Pepejal berwarna putih. <i>White solid.</i>	
Tambah 10 cm^3 air suling dan kacau untuk melarutkan pepejal U. <i>Add 10 cm^3 of distilled water and stir to dissolve solid U.</i>	Pepejal melarut untuk menghasilkan larutan tidak berwarna. <i>Solid dissolves to form a colourless solution.</i>	Ion logam peralihan tidak hadir. Maka, tiada ion Fe^{2+} , Fe^{3+} dan Cu^{2+} . <i>Transition metal ion is not present. Thus, absent of Fe^{2+}, Fe^{3+} and Cu^{2+} ions.</i>

(a) Kepada 1 cm ³ larutan U, tambah larutan natrium hidroksida sehingga berlebihan. <i>To 1 cm³ of the solution, add sodium hydroxide solution until excess.</i>	Mendakan putih yang terbentuk larut di dalam alkali berlebihan untuk menghasilkan larutan tidak berwarna. <i>White precipitate formed dissolves in excess alkali to form a colourless solution.</i>	Ion amfoterik seperti Pb ²⁺ , Al ³⁺ dan Zn ²⁺ mungkin hadir. <i>Amphoteric ions such as Pb²⁺, Al³⁺ and Zn²⁺ may be present.</i>
(b) Kepada 1 cm ³ larutan U, tambah larutan ammonia sehingga berlebihan. <i>To 1 cm³ of solution U, add ammonia solution until excess.</i>	Mendakan putih yang terbentuk larut di dalam alkali berlebihan untuk menghasilkan larutan tidak berwarna. <i>White precipitate formed dissolves in excess alkali to form a colourless solution.</i>	Zn ²⁺ hadir. <i>Zn²⁺ is present.</i>
(c) Kepada 1 cm ³ larutan U, tambah asid nitrik cair diikuti dengan larutan barium nitrat. <i>To 1 cm³ of solution U, add dilute nitric acid followed by barium nitrate solution.</i>	Mendakan putih yang terbentuk tidak larut di dalam asid. <i>White precipitate formed does not dissolve in acid.</i>	SO ₄ ²⁻ hadir. <i>SO₄²⁻ is present.</i>

zink sulfat, ZnSO₄, ion zink, Zn²⁺ dan ion sulfat, SO₄²⁻ / zinc sulphate, ZnSO₄, zinc ion, Zn²⁺ and sulphate ion, SO₄²⁻

9. (a) Zink oksida / Zinc oxide
- (b) (i) Zink karbonat / Zinc carbonate / ZnCO₃

$$\text{ZnCO}_3 + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2\text{O} + \text{CO}_2$$
- (ii) Garam tak terlarutkan / Insoluble salt
- (c) (i) Tindak balas T / Reaction T:
 Pemendakan / Penguraian ganda dua / Precipitation / Double decomposition
 Sebaitan M / Compound M:
 Natrium karbonat / kalium karbonat / ammonium karbonat / Na₂CO₃ / K₂CO₃ / (NH₄)₂CO₃
Sodium carbonate / potassium carbonate / ammonium carbonate / Na₂CO₃ / K₂CO₃ / (NH₄)₂CO₃
- (ii)
$$\text{ZnCl}_2 + \text{Na}_2\text{CO}_3 \rightarrow \text{ZnCO}_3 + 2\text{NaCl}$$

$$\text{ZnCl}_2 + \text{K}_2\text{CO}_3 \rightarrow \text{ZnCO}_3 + 2\text{KCl}$$

$$\text{ZnCl}_2 + (\text{NH}_4)_2\text{CO}_3 \rightarrow \text{ZnCO}_3 + 2\text{NH}_4\text{Cl}$$
- (iii) Tuangkan larutan garam X ke dalam dua tabung uji. Tambahkan larutan natrium hidroksida ke dalam tabung uji pertama sehingga berlebihan dan goncangkan. Pepejal putih yang terbentuk larut di dalam larutan natrium hidroksida berlebihan. Tambahkan larutan ammonia ke dalam tabung uji kedua sehingga berlebihan dan goncangkan. Pepejal putih yang terbentuk larut di dalam larutan ammonia berlebihan.

Pour salt solution X into two test tubes. Add sodium hydroxide solution in the first test tube until excess and shake. The white solid formed dissolves in excess sodium hydroxide solution. Add ammonia solution to the second test tube until excess and shake. The white solid formed dissolves in excess ammonia solution.



KBAT EKSTRA BAB 6

- Kilang membebaskan gas berasid seperti sulfur dioksida. Asid sulfurik di dalam air hujan mengion menghasilkan ion hidrogen. Ion hidrogen mengakis logam besi. Ion daripada asid meningkatkan kekonduksian elektrik bagi air yang diperlukan untuk pengaratan.
Factories release acidic gases such as sulphur dioxide. The sulphuric acid in rainwater ionises to produce hydrogen ions. Hydrogen ions corrode iron metal. Ions from the acid increase the electrical conductivity of water needed for rusting.
- Ammonia merupakan suatu bes.
Ammonia is a base.
 - Ammonia berlebihan boleh meningkatkan pH tanah. Tanah menjadi terlalu beralkali.
Excess ammonia will increase the pH of the soil. Soil becomes too alkaline.
 - Ammonia sangat larut di dalam air.
Ammonia is very soluble in water.
 - Air hujan yang membawa ammonia berlebihan ke dalam sungai boleh menyebabkan pencemaran air.
Rain water that carries excess ammonia into rivers can cause water pollution.

JAWAPAN

PRAKTIS SPM 3

Bab 5 - Bab 6

KERTAS 1

1. C 2. A 3. B 4. C 5. D
6. B 7. C 8. B 9. C 10. C
11. D 12. D 13. D

KERTAS 2

Bahagian A

1. (a) (i) N_2
(ii) $N_2 + 3H_2 \rightarrow 2NH_3$
(b) (i) Ikatan X / Bond X: Ikatan kovalen / Covalent bond
Ikatan Y / Bond Y: Ikatan hidrogen / Hydrogen bond
(ii) Takat lebur dan takat didih meningkat.
Melting point and boiling point of ammonia increase.
(c)
$$\left[\begin{array}{c} H \\ \cdot \times \\ H \times N \times H \\ \cdot \cdot \\ H \end{array} \right]^+$$
2. (a) (i) Tindak balas antara asid dengan alkali untuk menghasilkan garam dan air sahaja.
Reaction between an acid and an alkali to produce salt and water only.
(ii) $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$
(b) (i) $\frac{(24.2 + 24.1 + 24.0)}{3} = 24.1 \text{ cm}^3$
(ii) $\frac{1.0 \times 24.1}{M \times 25.0} = \frac{1}{2}$
 $M = 1.928 \text{ mol dm}^{-3}$
(c) (i) 48.2 cm^3
(ii) Asid sulfurik ialah asid diprotik, manakala asid nitrik ialah asid monoprotik. Kepekatan ion hidrogen di dalam asid sulfurik ialah dua kali ganda kepekatan ion hidrogen di dalam asid nitrik.

Sulphuric acid is a diprotic acid, while nitric acid is a monoprotic acid. The concentration of hydrogen ions in sulphuric acid is twice the concentration of hydrogen ions in nitric acid.

Bahagian B

3. (a) • Naftalena tidak larut di dalam air suling.
Naphthalene does not dissolve in water.
• Naftalena melebur di dalam air mendidih.
Naphthalene melts in boiling water.
• Naftalena larut di dalam sikloheksana.
Naphthalene dissolves in cyclohexane.
(b) • Naftalena mempunyai struktur molekul kovalen ringkas.
Naphthalene has a simple covalent molecular structure.
• Keterlarutan di dalam air
Solubility in water:
– Molekul naftalena yang bersifat neutral tidak bercampur dengan molekul air yang berkutub.
Non-polar naphthalene molecules do not mix with the polar water molecules.
• Keterlarutan di dalam pelarut organik
Solubility in organic solvent:
– Molekul naftalena yang tak berkutub bercampur dengan molekul sikloheksana yang juga tak berkutub.
Non-polar naphthalene molecules mix completely with cyclohexane molecules which are also non-polar.
• Takat lebur / *Melting point*
– Molekul naftalena terikat oleh daya tarikan van der Waals yang lemah.
Naphthalene molecules are bonded by weak van der Waals attractive forces.
– Sedikit tenaga diperlukan untuk mengatasi daya tarikan van der Waals yang lemah.
Less energy is required to overcome the weak van der Waals forces.
– Takat lebur naftalena adalah rendah dan tidak melebihi 100 °C.
The melting point of naphthalene is low and does not exceed 100 °C.

- (c) • Takat didih bagi H_2O adalah paling tinggi diikuti oleh H_2Te , H_2Se dan H_2S .

The boiling point of H_2O is the highest followed by H_2Te , H_2Se and H_2S .

- Semua sebatian hidrida terdiri daripada molekul ringkas.

All the hydride compounds are made up of simple molecules.

- Molekul air / Water molecule:

- Terikat oleh ikatan hidrogen.

Bonded by hydrogen bonds.

- Ikatan hidrogen adalah lebih kuat daripada daya tarikan van der Waals.

Hydrogen bond is stronger than van der Waals attraction forces.

- Banyak tenaga diperlukan untuk memutuskan ikatan hidrogen.

Kesannya, takat didih air sangat tinggi.

A lot of energy is required to break the hydrogen bonds. As a result, the boiling point of water is very high.

- Semua molekul hidrida selain H_2O :

All hydride molecules other than H_2O :

- Tidak membentuk ikatan hidrogen antara molekul.

Do not form hydrogen bonds between molecules.

- Terikat oleh daya tarikan van der Waals yang lemah.

Bonded by weak van der Waals attraction forces.

- Kekuatan daya tarikan van der Waals bertambah dengan peningkatan saiz molekul.

Strength of van der Waals attraction forces increases with the increasing of molecular size.

- Saiz molekul bertambah apabila menuruni kumpulan.

Molecular size increases when going down the group.

- Semakin banyak tenaga diperlukan untuk mengatasi daya tarikan van der Waals yang semakin kuat.

More energy is needed to overcome the stronger van der Waals attraction forces

- Maka, takat didih semakin bertambah.

Thus, the boiling point is increasing.

4. (a) – HX larut di dalam air dan pelarut organik.
HX is soluble in water and organic solvent.

- HX ialah asid kerana HX mengion untuk menghasilkan ion H^+ .

HX is an acid because it ionises to produce H^+ ions.

- HX ialah asid kuat kerana HX mengion lengkap di dalam air.

HX is a strong acid because it ionises completely in water.

- HX mengion di dalam air tetapi tidak mengion di dalam pelarut organik.

HX ionises in water but does not ionise in organic solvent.

- (b) – Bikar I: Serbuk zink melarut, pembuakan, gas tak berwarna dibebaskan.

Beaker I: Zinc powder dissolves, effervescence, colourless gas is released.

- Ion H^+ bertindak balas dengan logam reaktif zink untuk membentuk garam dan gas hidrogen.

H^+ ions react with reactive metal zinc to produce a salt and hydrogen gas.

- Bikar II: Tiada perubahan diperhatikan kerana HX tidak mengion di dalam pelarut organik.

Beaker II: No visible change is observed because HX does not ionise in organic solvent.

- Tiada ion H^+ untuk bertindak balas dengan zink.

No H^+ ions to react with zinc.

- (c) • Bilangan mol HX / Number of moles of HX

$$= \frac{0.480}{24}$$

$$= 0.02 \text{ mol}$$

- HX ialah asid monoprotik.

HX is a monoprotic acid.

Bilangan mol H^+ / Number of moles of H^+

$$= 0.02 \text{ mol}$$

Kepekatan ion H^+ / Concentration of H^+ ion

$$= \frac{0.02}{0.250}$$

$$= 0.08 \text{ mol dm}^{-3}$$

- $pH = -\log[H^+]$

$$= -\log[0.08]$$

$$= 1.09$$

$$\approx 1.1$$

Bahagian C

5. (a) • Setiap atom Al (2.8.3) menderma tiga elektron.

Each Al atom (2.8.3) donates three electrons.

- $Al \rightarrow Al^{3+} + 3e^-$

- Ion positif, Al^{3+} (2.8), mencapai susunan elektron oktet yang stabil

A positive ion, Al^{3+} (2.8) is formed to achieve a stable octet electron arrangement.

- Setiap atom O (2.6) menerima dua elektron untuk mencapai susunan elektron oktet yang stabil.

Each O atom (2.6) gains two electrons to achieve a stable octet electron arrangement.

- $O + 2e^- \rightarrow O^{2-}$
- Ion negatif, O^{2-} (2.8) mencapai susunan elektron oktet yang stabil.

A negative ion, O^{2-} (2.8), is formed to achieve a stable octet electron arrangement.

- Dua atom Al menderma enam elektron kepada tiga atom O

Two Al atoms donate six electrons to three O atoms.

- Ion Al^{3+} dan ion O^{2-} terikat oleh daya tarikan elektrostatik untuk membentuk ikatan ion.

Al^{3+} ion and O^{2-} ion are bonded by the electrostatic attraction force to form an ionic bond.

- (b) • Atom Al mempunyai tiga elektron valens, manakala atom Mg mempunyai dua elektron valens.

Al atom has three valence electrons, whereas Mg atom has two valence electrons.

- Lautan elektron dalam aluminium mengandungi lebih banyak elektron yang dinyahsetempatan.

The sea of electrons in aluminium contains more delocalised electrons.

- Lebih banyak elektron yang boleh bergerak bebas dan membawa cas.

More electrons can move freely and carry charges.

- Semakin tinggi ketumpatan elektron dalam lautan elektron, semakin tinggi kekonduksian elektrik.

The higher the electron density in the sea of electrons, the higher the electrical conductivity.

- (c) Hipotesis:

Hypothesis

Logam mengkonduksikan elektrik dalam keadaan pepejal, manakala sebatian ion tidak mengkonduksikan elektrik dalam keadaan pepejal.

Metals conduct electricity in the solid state, whereas ionic compounds do not conduct electricity in the solid state.

Pemboleh ubah:

Variables

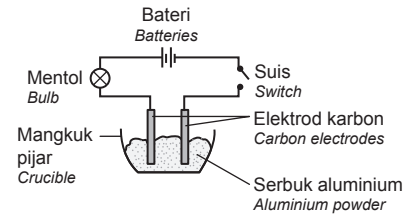
- dimanipulasikan: Jenis pepejal
manipulated: Types of solid
- bergerak balas: Kekonduksian elektrik
responding: Electrical conductivity
- dimalarkan: Keadaan fizik bahan
fixed: Physical state of substances

Prosedur :

Procedure:

1. Mangkuk pijar diisi dengan serbuk aluminium sehingga separuh penuh.
A crucible is half-filled with aluminium powder.

2. Susunan radas disediakan seperti di bawah.
The apparatus set-up is prepared as shown in the diagram below.



3. Suis dihidupkan dan perhatikan sama ada mentol menyala atau tidak.

The switch is on and the bulb lights up or not is observed.

4. Langkah 1 hingga 3 diulangi dengan menggunakan aluminium oksida.

Steps 1 to 3 are repeated with aluminium oxide.

5. Semua pemerhatian direkodkan dalam jadual.

All observations are recorded in a table.

Keputusan / Result:

Bahan Substance	Pemerhatian Observation
Aluminium Aluminium	Mentol menyala Bulb lights up
Aluminium oksida Aluminium oxide	Mentol tidak menyala Bulb does not light up

6. (a) – Kation: Ion plumbum(II), Pb^{2+}

Cation: Lead(II) ion, Pb^{2+}

- Anion: Ion nitrat, NO_3^-

Anion: Nitrate ion, NO_3^-

- Plumbum(II) nitrat, $Pb(NO_3)_2$

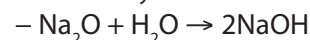
Lead(II) nitrate, $Pb(NO_3)_2$

- (b) – P: Natrium oksida / Sodium oxide



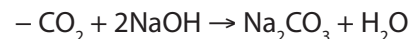
- Q: Larutan natrium hidroksida

Sodium hydroxide solution



- R: Larutan natrium karbonat

Sodium carbonate solution

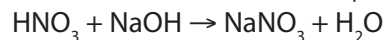


(c) Prosedur / Procedure:

1. 25.0 cm³ asid nitrik dipipetkan ke dalam sebuah kelalang kon yang bersih.
25.0 cm³ of nitric acid is pipetted into a clean conical flask.
2. 2 – 3 titis penunjuk fenolftalein ditambah ke dalam asid nitrik
2 – 3 drops of phenolphthalein indicator is added into nitric acid.
3. Sebuah buret yang bersih diisi dengan larutan natrium hidroksida. Bacaan awal buret direkodkan.
A clean burette is filled with sodium hydroxide solution. The initial burette reading is recorded.
4. Larutan natrium hidroksida ditambah secara perlahan-lahan ke dalam kelalang kon sehingga penunjuk fenolftalein bertukar daripada tak berwarna kepada merah jambu. Bacaan buret akhir direkodkan. Kemudian, isi padu natrium hidroksida yang diperlukan untuk meneutralkan 25 cm³ asid nitrik ditentukan.
Sodium hydroxide solution is added slowly into the flask until the phenolphthalein indicator changes colour from colourless to pale pink. The final burette reading is recorded. Then, the volume of sodium hydroxide required to neutralise 25 cm³ of nitric acid is determined.

5. Isi padu larutan natrium hidroksida yang ditentukan ditambah secara pentitratan ke dalam 25.0 cm³ asid nitrik.
The volume of sodium hydroxide solution determined is added via titration into 25.0 cm³ nitric acid.
6. Kandungan kelalang kon dituang ke dalam mangkuk penyejat.
The content of the conical flask is poured into an evaporating dish.
7. Larutan campuran dipanaskan sehingga larutan garam tepu.
The mixture solution is heated until the salt solution is saturated.
8. Campuran dibiarkan menyejuk perlahan-lahan supaya penghabluran berlaku.
The mixture is allowed to cool slowly for crystallisation to occur.
9. Hablur yang terbentuk dituras.
The crystals formed are filtered out.
10. Hablur dikeringkan di antara kertas turas.
The crystals are dried between filter papers.

Persamaan kimia / Chemical equation:



JAWAPAN

BAB 7

7.1 Penentuan Kadar Tindak Balas Determining Rate of Reaction

1. (a) Tindak balas cepat / *Fast reaction*
Tindak balas lambat / *Slow reaction*
- (b) Perubahan kuantiti bahan tindak balas atau hasil tindak balas per unit masa.
Changes in the quantity of the reactant or product per unit time.

- (c) Peningkatan jisim karat
Increase in mass of rust

$$(d) (i) = \frac{250}{20} = 12.5 \text{ g s}^{-1}$$

- (ii) Kadar tindak balas meningkat.
Rate of reaction increases.

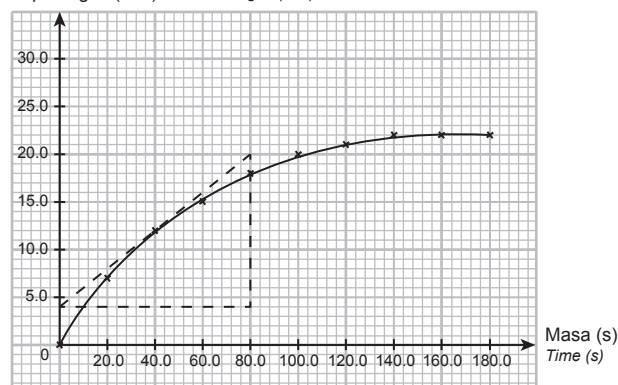
2.

Tindak balas <i>Reaction</i>	Zink, Zn dengan asid sulfurik, H_2SO_4 <i>Zinc, Zn and sulphuric acid, H_2SO_4</i>	Asid nitrik, HNO_3 dengan ketulan marmar, CaCO_3 <i>Nitric acid, HNO_3 and marble chips, CaCO_3</i>	Larutan kalium iodida, KI dan larutan plumbum(II) nitrat, $\text{Pb}(\text{NO}_3)_2$ <i>Potassium iodide solution, KI and lead(II) nitrate solution, $\text{Pb}(\text{NO}_3)_2$</i>
(a) Perubahan yang diukur <i>Measurable change</i>	Isi padu gas hidrogen <i>Volume of hydrogen gas</i>	Jisim ketulan marmar <i>Mass of marble chips</i>	Jisim plumbum(II) iodida <i>Mass of lead(II) iodide</i>
(b) Persamaan kimia <i>Chemical equation</i>	$\text{Zn}(\text{p}) + \text{H}_2\text{SO}_4(\text{ak}) \rightarrow \text{ZnSO}_4(\text{ak}) + \text{H}_2(\text{g})$ $\text{Zn}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{H}_2(\text{g})$	$\text{CaCO}_3(\text{p}) + 2\text{HNO}_3(\text{ak}) \rightarrow \text{Ca}(\text{NO}_3)_2(\text{ak}) + \text{H}_2\text{O}(\text{ce}) + \text{CO}_2(\text{g})$ $\text{CaCO}_3(\text{s}) + 2\text{HNO}_3(\text{aq}) \rightarrow \text{Ca}(\text{NO}_3)_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$	$\text{Pb}(\text{NO}_3)_2(\text{ak}) + 2\text{KI}(\text{ak}) \rightarrow \text{PbI}_2(\text{p}) + 2\text{KNO}_3(\text{ak})$ $\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{KI}(\text{aq}) \rightarrow \text{PbI}_2(\text{s}) + 2\text{KNO}_3(\text{aq})$
(c) Bagaimanakah tindak balas lengkap ditentukan? <i>How to determine the reaction has completed?</i>	<ul style="list-style-type: none"> Pembuakan berhenti <i>Effervescence is stopped</i> Tiada lagi gelembung gas terbebas <i>No more gas bubbles is released</i> 	<ul style="list-style-type: none"> Pembuakan berhenti <i>Effervescence is stopped</i> Tiada lagi gelembung gas terbebas <i>No more gas bubbles is released</i> Jisim ketulan marmar tidak berubah <i>Mass of marble chips does not change</i> 	Tiada pembentukan mendakan lagi <i>No more precipitate formation</i>

3. (a) Kadar tindak balas pada masa tertentu
Instantaneous rate of reaction
- (b) Kadar tindak balas purata
Average rate of reaction

4. (a)

Isi padu gas (cm^3) / *Volume of gas (cm^3)*



(b) (i) $\frac{15}{60} = 0.25 \text{ cm}^3 \text{ s}^{-1}$

(ii) $\frac{22}{140} = 0.16 \text{ cm}^3 \text{ s}^{-1}$

 (c) [Lukis tangent pada 40 s, tentukan kecerunan]
 [Draw a tangent at 40 s, determine the gradient]

$$\frac{20 - 4}{80 - 0} = 0.20 \text{ cm}^3 \text{ s}^{-1}$$

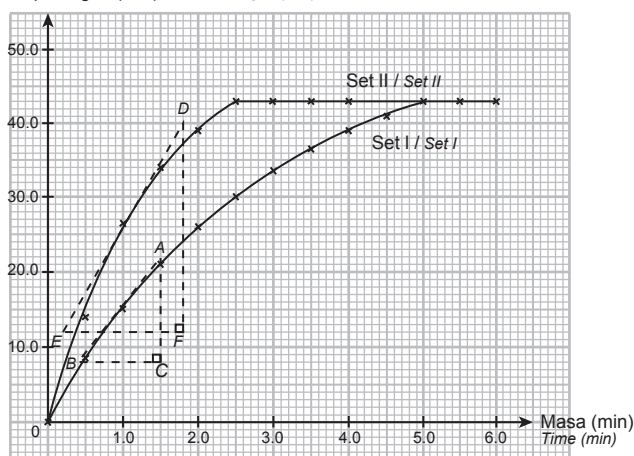
7.2 Faktoryang Mempengaruhi Kadar Tindak Balas

Factors Affecting Rate of Reactions

1. A. Saiz bahan tindak balas / Size of reactants

Mentafsir data / Interpreting data:

(a) (i)

 Isi padu gas (cm^3) / Volume of gas (cm^3)


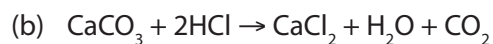
(ii) Set I: $\frac{43}{5} = 8.6 \text{ cm}^3 \text{ min}^{-1}$

Set II: $\frac{43}{2.5} = 17.2 \text{ cm}^3 \text{ min}^{-1}$

(iii) Set I: $\frac{AB}{BC} = \frac{14}{1.1}$
 $= 12.73 \text{ cm}^3 \text{ min}^{-1}$

Set II: $\frac{DF}{EF} = \frac{27}{1.6}$

$= 16.88 \text{ cm}^3 \text{ min}^{-1}$



(c) (i) tinggi / higher

(ii) besar, tinggi / bigger, higher

(d) (i) Semakin kecil saiz bahan tindak balas, semakin besar jumlah luas permukaan bahan tindak balas yang terdedah untuk tindak balas kimia berlaku.

The smaller the size of reactant, the bigger the total surface area of reactant exposed for the chemical reaction to occur.

(ii) Semakin besar jumlah luas permukaan bahan tindak balas, semakin tinggi kadar tindak balas.

The bigger the total surface area of the reactant, the higher the rate of reaction.

Kesimpulan / Conclusion:

Semakin kecil saiz bahan tindak balas, semakin tinggi kadar tindak balas.

The smaller the size of reactant, the higher the rate of reaction.

B. Kepekatan

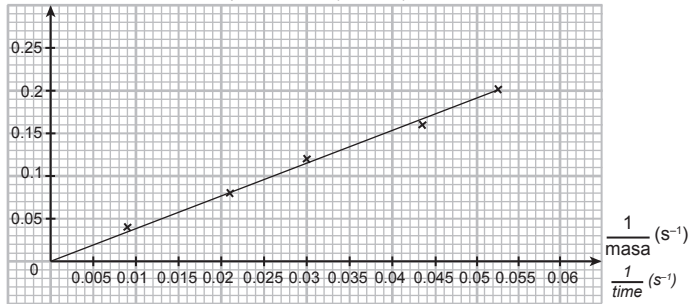
Concentration

Eksperimen Experiment	1	2	3	4	5
Isi padu larutan stok natrium tiosulfat 0.2 mol dm^{-3} (cm^3) Volume of 0.2 mol dm^{-3} sodium thiosulphate stock solution (cm^3)	45.0	40.0	30.0	20.0	10.0
Isi padu air suling (cm^3) Volume of distilled water (cm^3)	0.0	5.0	15.0	25.0	35.0
Isi padu H_2SO_4 (cm^3) Volume of H_2SO_4 (cm^3)	5.0	5.0	5.0	5.0	5.0
Kepekatan larutan natrium tiosulfat (mol dm^{-3}) Concentration of sodium thiosulphate solution (mol dm^{-3})	0.2	0.16	0.12	0.08	0.04
Masa yang diambil (s) Time taken (s)	19	23	33	48	115
$\frac{1}{\text{masa}} (\text{s}^{-1}) / \frac{1}{\text{time}} (\text{s}^{-1})$	0.0526	0.0435	0.0303	0.0208	0.0087

Mentafsir data / Interpreting data:

(a) (i)

Kepekatan larutan natrium tiosulfat (mol dm⁻³)
Concentration of sodium thiosulphate solution (mol dm⁻³)



(ii) $\frac{1}{\text{masa}}$ ialah kadar tindak balas.
 $\frac{1}{\text{time}}$ is the rate of reaction.

(iii) Semakin tinggi kepekatan larutan natrium tiosulfat, semakin tinggi kadar tindak balas.
The higher the concentration of sodium thiosulphate solution, the higher the rate of reaction.

(b) (i) Pepejal kuning terhasil.
Yellow solid is produced.

(ii) Sulfur / Sulphur

Kesimpulan / Conclusion:

Semakin tinggi kepekatan bahan tindak balas, semakin tinggi kadar tindak balas.
The higher the concentration of reactant, the higher the rate of reaction.

C. Suhu
Temperature

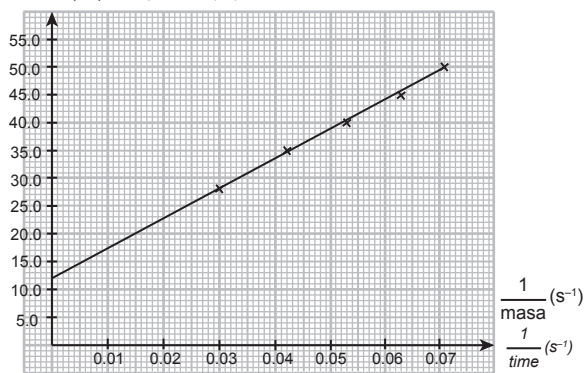
Keputusan / Result:

0.030, 0.042, 0.053, 0.063, 0.071

Mentafsir data / Interpreting data:

(a) (i)

Suhu (°C) / Temperature (°C)



(ii) Semakin tinggi suhu larutan natrium tiosulfat, semakin tinggi kadar tindak balas.

The higher the temperature of sodium thiosulphate solution, the higher the rate of reaction.

(b) (i) $S_2O_3^{2-} + 2H^+ \rightarrow H_2O + SO_2 + S$

(ii) Boleh, kerana ion hidrogen daripada asid yang terlibat dalam tindak balas.
Can, because hydrogen ion from the acid are involved in the reaction.

Kesimpulan / Conclusion:

Semakin tinggi suhu bahan tindak balas, semakin tinggi kadar tindak balas.
The higher the temperature of reactant, the higher the rate of reaction.

D. Kehadiran mangkin
Presence of catalyst

Keputusan / Result:

Tabung uji Test tube	Pemerhatian Observation	Inferens Inference
Set I Set I	<ul style="list-style-type: none"> Sedikit gelembung udara terhasil Less air bubbles are produced Membara malap Glowing dimly 	Sedikit gas oksigen Less oxygen gas
Set II Set II	<ul style="list-style-type: none"> Banyak gelembung udara More air bubbles are produced Menyala terang Burning brightly 	Banyak gas oksigen More oxygen gas

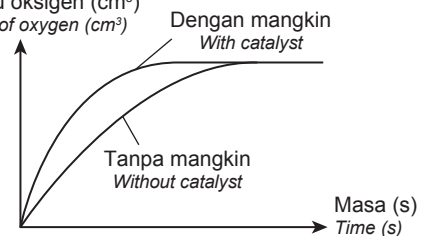
Mentafsir data / Interpreting data:

(a) $2H_2O_2 \rightarrow O_2 + 2H_2O$

(b) Bertindak sebagai mangkin dengan merendahkan tenaga pengaktifan untuk mempercepat kadar tindak balas.

Acts as a catalyst by lowering the activation energy to speed up the rate of reaction.

(c) Isi padu oksigen (cm³)
Volume of oxygen (cm³)

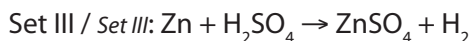
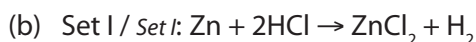


Kesimpulan / Conclusion:

Kehadiran mangkin meningkatkan kadar tindak balas.

Presence of catalyst increases the rate of reaction.

2. (a) Hidrogen / Hydrogen



(c) Set I / Set I:	Set II / Set II:
$= \frac{50}{70}$	$= \frac{50}{85}$
$= 0.714 \text{ cm}^3 \text{ s}^{-1}$	$= 0.588 \text{ cm}^3 \text{ s}^{-1}$

Set III / Set III:

$$= \frac{50}{55}$$

$$= 0.909 \text{ cm}^3 \text{ s}^{-1}$$

(d) (i) Kadar tindak balas dalam Set I lebih tinggi berbanding dengan Set II kerana saiz serbuk zink lebih kecil berbanding dengan ketulan zink. Jumlah luas permukaan serbuk zink lebih besar berbanding dengan ketulan zink.

Rate of reaction of Set I is higher than Set II because the size of zinc powder is smaller than zinc granule. Total surface area of zinc powder is bigger than zinc granule.

(ii) Kadar tindak balas dalam Set I lebih rendah berbanding dengan Set III kerana kepekatan ion hidrogen dalam Set I lebih rendah berbanding dengan Set III. Kurang ion hidrogen per unit isi padu dalam Set I berbanding dengan Set III.

Rate of reaction in Set I is lower than Set III because the concentration of hydrogen ions in Set I is lower than Set III. Less hydrogen ions per unit volume in Set I than Set III.

Aplikasi Faktor yang Mempengaruhi Kadar Tindak Balas dalam Kehidupan
7.3 Application of Factors that Affect the Rate of Reaction in Daily Life

1. (a) Ayam B. Saiz ayam B lebih kecil berbanding dengan ayam A. Lebih banyak haba dapat diserap oleh ayam B kerana jumlah luas permukaan ayam B lebih besar berbanding dengan ayam A. Oleh itu, ayam B akan masak dengan lebih cepat.

Chicken B. Size of chicken B is smaller than chicken A. More heat can be absorbed by chicken B because the total surface area of chicken B is bigger than chicken A. Therefore, chicken B will cook faster.

(b) Pilihan Azie adalah betul kerana takat didih minyak adalah lebih tinggi berbanding dengan takat didih air. Maka, lebih banyak haba dapat dipindahkan kepada ayam B apabila digoreng berbanding dengan direbus. Oleh itu, ayam B akan lebih cepat masak apabila digoreng.

Azie's choice is correct because the boiling point of oil is higher than the boiling point of water. Therefore, more heat can be transferred to chicken B through frying than boiling. Hence, chicken B will cook faster through frying.

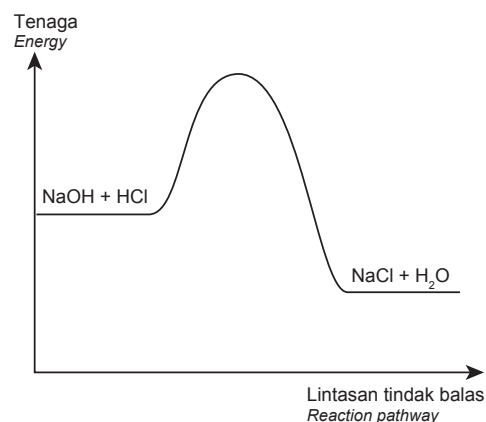
(c) Ayam dimasak di dalam periuk tekanan.
Chicken is cooked in a pressure cooker.

7.4 Teori Perlanggaran
Collision Theory

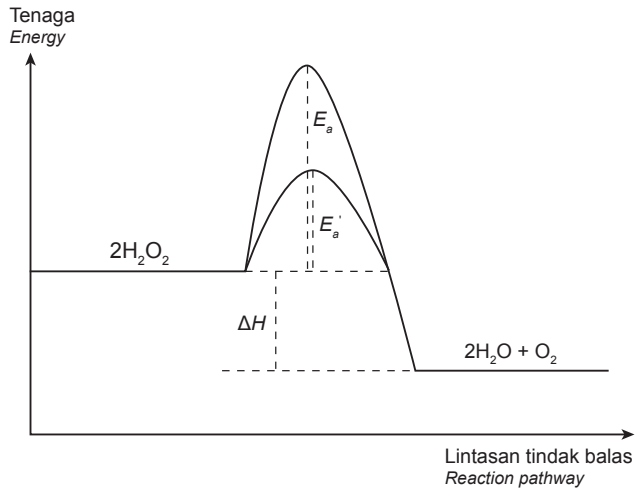
- (a) (i) diskrit; bergerak / discrete; move
(ii) berlanggar / collide

(b) (i) pemindahan; cepat; perlahan
transfer; Fast; slow
(ii) kinetik / kinetic
(iii) berlanggar; berkesan / collide; effective
- Zarah bahan tindak balas mesti berlanggar pada orientasi yang betul.
Reactant particles must collide in the correct orientation.
 - Zarah bahan tindak balas mesti mempunyai tenaga yang sama atau melebihi tenaga pengaktifan.
Reactant particles must have energy equal or more than the activation energy
- Tenaga pengaktifan adalah seperti halangan bagi kambing biri-biri itu.
Zarah-zarah bahan tindak balas perlu mempunyai tenaga yang mencukupi untuk memulakan tindak balas. Tenaga ini adalah tenaga minimum.
Activation energy is like the barrier for the lamb. The reactant particles need to have enough energy to initiate a reaction. The energy is the minimum energy.

4. (a) ✓



5. (a) Tenaga minimum yang diperlukan oleh zarah-zarah untuk memulakan tindak balas.
Minimum energy needed by particles to initiate a reaction.
- (b) Untuk memutuskan ikatan dalam zarah bahan tindak balas dan membentuk ikatan baharu dalam hasil tindak balas.
To break the bonds in the reactant particles and form new bonds in the product.
- (c) Eksotermik / Exothermic
- (d) (i) & (ii)



- (e) Kadar tindak balas akan meningkat. Mangan(IV) oksida bertindak sebagai mangkin dan menyediakan lintasan alternatif yang merendahkan tenaga pengaktifan. Lebih banyak molekul H_2O_2 boleh mencapai tenaga pengaktifan yang lebih rendah. Frekuensi perlanggaran berkesan antara molekul H_2O_2 meningkat.

Rate of reaction will increase. Manganese(IV) oxide acts as a catalyst and provides an alternative pathway that lowers the activation energy. More H_2O_2 molecules can achieve the lower activation energy. Frequency of effective collisions between H_2O_2 molecules increases.

- (f) Kerana mangkin bertindak secara khusus untuk sesuatu tindak balas
Because a catalyst acts specifically for a reaction



KBAT EKSTRA BAB 7

- (a) Tindak balas cuka dengan serbuk penaik menghasilkan gas karbon dioksida yang menolak roket itu ke atas.
Reaction between vinegar and baking soda produces carbon dioxide gas that push the rocket upwards.
- (b)
- Asid hidroklorik / Hydrochloric acid
 - Asid hidroklorik ialah asid kuat // mengion lengkap di dalam air.
Hydrochloric acid is a strong acid // ionises completely in water.
 - Menghasilkan kepekatan ion hidrogen yang lebih tinggi.
Produces higher concentration of H^+ .
 - Bertindak balas lebih cepat dengan serbuk penaik untuk menghasilkan lebih banyak gas karbon dioksida.
Reacts faster with baking soda to produce more carbon dioxide gas.

8.1 Aloi dan Kepentingan Alloy and Its Importance

1. (a) Bahan yang terhasil daripada campuran dua atau lebih unsur dengan unsur utamanya ialah logam.

Substance formed from a mixture of two or more elements in which the main elements is a metal.

- (b) Kenderaan A / Vehicle A: Keluli / Steel
Kenderaan B / Vehicle B: Duralumin / Duralumin
- (c) Ketumpatan yang rendah / tidak berkarat / tahan kakisan / lebih kuat daripada aluminium tulen.

Low density / does not rust / resistant to corrosion / stronger than pure aluminium.

- (d) (i) Kenderaan A akan mudah berkarat / terkakis dan menjadi kurang keras.

Vehicle A will rust / corrode easily and become less hard.

- (ii) Aloi itu menjadi kurang keras / lebih cepat berkarat.

The alloy will become less hard / rust faster.

2. A. Sifat tahan kakisan bahan

Resistance to corrosion

Keputusan / Result:

Kepingan Plate	Perubahan pada permukaan kepingan <i>Changes on the surface of the plate</i>	
	Sebelum direndam di dalam air suling <i>Before immersing in the distilled water</i>	Selepas direndam di dalam air suling <i>After immersing in the distilled water</i>
Besi <i>Iron</i>	Pudar // kurang berkilat dan tiada tompok perang <i>Dull // less shiny and no brown spot</i>	Tompok perang terbentuk (karat) <i>Brown spot is formed (rust)</i>
Keluli nirkarat <i>Stainless steel</i>	Berkilat dan tiada tompok perang <i>Shiny and no brown spot</i>	Tiada perubahan <i>No changes</i>

Perbincangan / Discussion:

- (a) lapisan oksida
oxide layer

- (b) besi, keluli nirkarat
iron, stainless steel

B. Sifat tahan kakisan bahan

Resistance to corrosion

Keputusan / Result:

Jenis blok Type of block	Diameter lekuk pada blok <i>Diameter of dent on the block</i>				Purata (cm) Average (cm)
	1	2	3	4	
Kuprum <i>Copper</i>	4.4	4.3	4.3	4.3	4.3
Gangsa <i>Bronze</i>	3.1	3.0	3.2	3.2	3.1

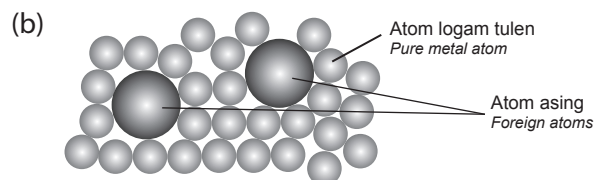
Perbincangan / Discussion:

- (a) kecil / *smaller*
(b) kecil / *smaller*

3.

Aloi Alloy	Sifat Properties	Logam tulen Pure metal
Berkilat <i>Shiny</i>	Permukaan <i>Surface</i>	Kurang berkilat <i>Less shiny</i>
Lebih keras <i>Harder</i>	Kekerasan <i>Hardness</i>	Kurang keras <i>Less harder</i>
Tahan kakisan <i>Resistant to corrosion</i>	Tahan kakisan <i>Resistant to corrosion</i>	Mudah terkakis <i>Easy to corrode</i>

4. (a) (i) mulur; ditarik
ductile; pulled
(ii) boleh ditempa; struktur
malleable; structure



5.

Sifat <i>Properties</i>	Logam tulen <i>Pure metal</i>	Aloi <i>Alloy</i>
Susunan atom <i>Atomic arrangement</i>	Atom dengan saiz yang sama tersusun secara teratur. <i>Atom with the same size is orderly arranged.</i>	Kehadiran atom asing dengan saiz yang berbeza mengganggu susunan teratur atom logam tulen. <i>The presence of foreign atoms of different size disrupt the orderly arrangement of pure metal atoms.</i>
Perubahan apabila dikenakan daya <i>Changes when force is applied</i>	Mudah tergelongsor di atas satu sama lain (kerana saiz atom yang sama) <i>Slide over easily onto one another (because of the same atomic size)</i>	Kehadiran atom asing menghalang lapisan atom-atom ini daripada menggelongsor dengan mudah. <i>The presence of foreign atoms prevent the atomic layers from slide over easily.</i>
Kekerasan <i>Hardness</i>	Lebih lembut <i>Softer</i>	Lebih keras <i>Harder</i>

6. (a) Gangsa
Bronze
(b) Loyang
Brass
(c) Keluli
Steel
(d) Keluli nirkarat
Stainless steel
(e) Duralumin
Duralumin
(f) Piuter
Pewter

8.2 Komposisi Kaca dan Kegunaannya
Composition of Glass and Its Uses

1. (a) • Kaca soda kapur
Soda-lime glass
• Kaca borosilikat
Borosilicate glass
(b) Keras tetapi rapuh / lengai secara kimia / lut sinar / kalis air / penebat haba / penebat elektrik

Hard but brittle / chemically inert / transparent / waterproof / heat insulator / electrical insulator

- (c) Pekali pengembangan yang rendah / lebih tahan haba
Low expansion coefficient / more heat resistant
(d) (i) Silika / silikon dioksida
Silica / silicon dioxide / SiO₂
(ii) Boron oksida, aluminium oksida
Boron oxide, aluminium oxide / B₂O₃, Al₂O₃
(e) Indeks pembiasan yang biasa tinggi
High refractive index

8.3 Komposisi Seramik dan Kegunaannya
Composition of Ceramics and Its Uses

1. (a) bukan organik, bukan logam
inorganic, non-metallic
(b) pembentukan, pengerasan
shaping, hardening
2. (a) Aluminium oksida, Al₂O₃
Aluminium oxide, Al₂O₃
(b) Titanium karbida, TiC
Titanium carbide, TiC
(c) Silikon karbida, SiC
Silicon carbide, SiC
3. • Keras dan kuat
Hard and strong
• Lengai secara kimia
Chemically inert
• Mudah pecah
Easily crack
• Penebat elektrik
Electrical insulator
• Penebat haba
Heat insulator
• Rintangan haba tinggi
High heat resistant
4. (a) Pepejal yang terdiri daripada bahan bukan organik dan bahan bukan logam.
Solid made up of inorganic and non-metallic substances.
(b) Penebat haba / penebat elektrik / keras dan kuat / lengai secara kimia / mudah pecah / rintangan haba yang tinggi
Thermal insulator / electrical insulator / hard and strong / chemically inert / easy to break / high heat resistance
(c) Seramik X / *Ceramics X*: Seramik termaju, cakera pemotong / *Advanced ceramic, cutting disk*
Seramik Y / *Ceramics Y*: Seramik tradisional, batu-bata / *Traditional ceramic, brick*
(d) Sifat superkonduktiviti
Superconductivity property
5. (a) Benar / *True*

- (b) Palsu / False
- (c) Benar / True
- (d) Palsu / False

8.4 **Bahan Komposit dan Kegunaannya**
Composite Materials and Its Importance

1. (a) Bahan yang terdiri daripada gabungan dua atau lebih bahan yang bukan homogen iaitu bahan matriks dan bahan pengukuhan.
Material made from combining two or more non-homogeneous substances which are matrix substance and strengthening substance.
- (b) X: Bahan pengukuhan
Strengthening substance
Y: Bahan matriks
Matrix substance

2.

Bahan komposit <i>Composite material</i>	Bahan matriks <i>Matrix substance</i>	Bahan pengukuhan <i>Strengthening substance</i>
(a) Konkrit diperkukuhkan <i>Reinforced concrete</i>	Konkrit <i>Concrete</i>	Tetulang keluli atau jejaring dawai <i>Steel bars or wire mesh</i>
(b) Kaca gentian <i>Fibre glass</i>	Plastik <i>Plastic</i>	Gentian kaca <i>Glass fibres</i>
(c) Gentian optik <i>Optical fibre</i>	<ul style="list-style-type: none"> • Salutan kaca atau plastik <i>Glass or plastic coating</i> • Jaket pelindung plastik <i>Plastic protective jacket</i> 	Gentian kaca silika <i>Silica glass fibres</i>
(d) Kaca fotokromik <i>Photochromic glass</i>	Kaca <i>Glass</i>	Argentum klorida, AgCl dan kuprum(I) klorida, CuCl <i>Silver chloride, AgCl and copper(I) chloride, CuCl</i>

3. Tambahkan tetulang keluli sebagai bahan pengukuhan kepada konkrit yang bertindak sebagai bahan matriks untuk membina satu jambatan baharu yang diperbuat daripada konkrit yang diperkukuhkan. Jambatan ini akan mempunyai kekuatan regangan yang lebih tinggi dan tahan kakisan.

Add steel bars as a strengthening substance to the concrete that acts as a matrix substance to build a bridge that is made from reinforced concrete. This bridge will have higher compression strength and resistant to corrosion.

4. (a) (i) Konkrit / *Concrete*
(ii) • Kekuatan regangan yang tinggi
High stretching strength
• Mudah karat / *Easily corrodes*
- (b) (ii) Gentian kaca / *Glass fibre*
(iii) • Kekuatan regangan tinggi
High stretching strength
• Penebat haba dan elektrik
Electrical and heat insulator
• Tahan lasak / *Durable*
• Tahan hakisan / *Resistant to corrosion*
- (c) (i) • Kekuatan mampatan yang tinggi
High compression strength
• Fleksibel / *Flexible*
(iii) Gentian optik / *Optical fibre*
- (d) (i) Kaca / *Glass*
(ii) Argentum klorida
Silver chloride
(iii) Kaca fotokromik
Photochromic glass
- (e) (i) Rintangan elektrik yang tinggi pada suhu bilik
High resistant to electrical at room temperature
(ii) Tiada rintangan elektrik pada suhu yang sangat rendah
No electrical resistant at a very low temperature

KBAT EKSTRA BAB 8

- (a) Superkonduktor
Superconductor
- (b) Tiada rintangan elektrik pada suhu yang sangat rendah menyebabkan kereta api bergerak tanpa geseran dan meningkatkan kelajuan kereta api.
No electrical resistance at very low temperature causes the train to move without friction and increases the speed of train.
- (c) Mesin MRI // Resonans magnet nukleus (NMR) // Pemecut zarah
MRI machine // Nucleus magnet resonance (NMR) // Particle accelerator

JAWAPAN

PRAKTIS SPM 4

Bab 7 - Bab 8

KERTAS 1

1. C 2. A 3. D 4. C 5. B
6. C 7. C 8. C 9. C 10. D
11. D 12. C 13. D

KERTAS 2

Bahagian A

1. (a) Tindak balas cepat / *Fast reaction*:
Letupan / *Explosion*
Tindak balas perlahan / *Slow reaction*:
Fotosintesis / pengaratan
Photosynthesis / rusting
- (b) (i) Perubahan kuantiti bahan tindak balas atau hasil tindak balas per unit masa.
Change of quantity of reactants or products per unit time.
- (ii) Set I / *Set I*: $\frac{50}{210} = 0.238 \text{ cm}^3 \text{ s}^{-1}$
Set II / *Set II*: $\frac{50}{150} = 0.333 \text{ cm}^3 \text{ s}^{-1}$
- (iii) Set II. Jumlah luas permukaan / *Set II. Total surface area*
- (c) Set I. Saiz daging yang kecil / jumlah luas permukaan daging lebih besar. Maka, lebih banyak haba diserap.
Set I. Small size of beef / larger total surface area of beef. Thus, more heat is absorbed.
2. (a) Jenis / *Type*: Kaca plumbum / *Lead crystal glass*
Kegunaan / *Use*: Prisma / *Prisms*
- (b) Seramik mempunyai rintangan haba tinggi / legap
Ceramics have high heat resistance / opaque
- (c) (i) Argentum klorida / kuprum(I) klorida / *Silver chloride / copper(I) chloride*
- (ii) • Pembentukan atom argentum, Ag menghalang laluan cahaya.
The formation of silver atoms, Ag prevents the passage of light.
- Apabila keadaan malap, kuprum(I) klorida, CuCl di dalam kaca fotokromik membolehkan pembalikan proses supaya kaca menjadi lut sinar semula.

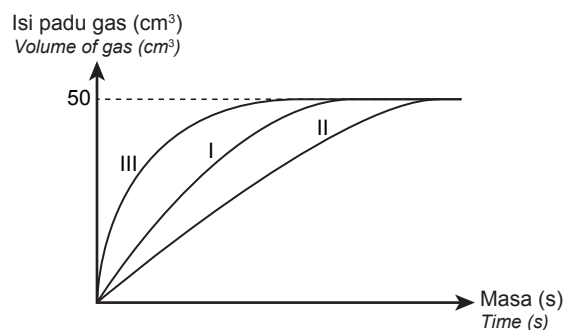
In dim light, copper(I) chloride, CuCl in photochromic glass catalyses the reverse process so that glass becomes transparent again.

- (iii) Tingkap kereta gelap / tingkap bangunan gelap

Tinted car window / tinted building window

Bahagian B

3. (a) Faktor : Saiz / Jumlah luas permukaan
Factor: Size / Total surface area
Saiz kentang yang lebih kecil mempunyai jumlah luas permukaan yang lebih besar. Lebih banyak haba dapat diserap. Maka, kentang cepat masak. / Jumlah luas permukaan yang lebih besar akan meningkatkan kadar tindak balas.
Potatoes with smaller has larger total surface area. More heat can be absorbed. Thus, the potatoes are cooked faster. The larger total surface area will increase the rate of reaction.
- (b) (i) $\text{CaCO}_3 + 2\text{HNO}_3 \rightarrow \text{Ca}(\text{NO}_3)_2 + \text{H}_2\text{O} + \text{CO}_2$
Bilangan mol HNO_3 / *Number of moles of HNO₃*
 $= \frac{50 \times 1.0}{1000} = 0.05 \text{ mol}$
Nisbah mol
Mole ratio
 $2 \text{ mol HNO}_3 : 1 \text{ mol CO}_2$
 $0.05 \text{ mol HNO}_3 : 0.025 \text{ mol CO}_2$
Isi padu CO_2 / *Volume of CO₂*
 $= 0.025 \times 24 = 0.6 \text{ dm}^3 / 600 \text{ cm}^3$
- (ii)



(iii) II, I, III

 Set I dan Set II / *Set I and Set II:*

- Kadar tindak balas Set I lebih tinggi.
Rate of reaction of Set I is higher.
- Faktor ialah saiz // jumlah luas permukaan.
Factor is size // total surface area.
- Saiz lebih kecil // jumlah luas permukaan kalsium karbonat lebih besar.
Smaller size // total surface area of calcium carbonate is larger.
- Jumlah luas permukaan yang terdedah kepada perlanggaran meningkat
The total surface area exposed to the collision increases.
- Frekuensi perlanggaran antara zarah-zarah lebih tinggi.
Frequency of collisions between particles is higher.
- Frekuensi perlanggaran berkesan lebih tinggi.
Frequency of effective collisions is higher.

4. (a) (i) P: Kaca plumbum / *Lead crystal glass*
Kegunaan P: Sebagai barang hiasan / lampu kristal / prisma
Use of P: As decorative items / crystal chandeliers / prisms

Q: Kaca borosilikat / *Borosilicate glass*
Kegunaan Q: Alatan dapur / radas makmal
Use of Q: Kitchen utensils / laboratory apparatus

(ii) P: Mempunyai indeks pembiasan yang tinggi

P: Has a high refractive index

Q: Pekali pengembangan yang rendah / tahan haba

Q: Low expansion coefficient / resistant to heat

- (b) • Keluli diperbuat daripada gabungan dua jenis unsur iaitu atom karbon dan atom besi.
Steel is made from the combination between carbon atom and iron atom.
- Besi ialah logam tulen yang hanya mempunyai satu jenis atom yang sama saiz.
Iron is a pure metal that has only one type of atom of the same size.
 - Kehadiran atom asing (atom karbon) yang berlainan saiz akan mengganggu susunan teratur logam tulen (logam besi).

The presence of foreign atoms (carbon atoms) of different sizes disrupts the orderly arrangement of the pure metal.

- Apabila daya dikenakan, atom-atom di dalam keluli tidak mudah menggelongsor antara satu sama lain.
When force is applied, it is hard for the atoms in the steel to slide over each other.

(c) (i)

Bahan <i>Substance</i>	Nama <i>Name</i>	Ciri istimewa <i>Special characteristic</i>
W	Seramik <i>Ceramics</i>	Tahan haba yang tinggi / Lengai terhadap bahan kimia <i>Withstand high heat / Inert to chemicals</i>
X	Kaca fotokromik <i>Photochromic glass</i>	Sensitif terhadap keamatan cahaya <i>Sensitive to light intensity</i>
Y	Kaca gentian <i>Fibre glass</i>	Ringan tetapi kuat / Kekuatan regangan yang tinggi / Tahan lasak <i>Lightweight but strong / High tensile strength / Durable</i>
Z	Gentian optik <i>Optical fibre</i>	Kekuatan mampatan yang tinggi / Fleksibel <i>High compression strength / Flexible</i>

(ii) Teknologi hijau dan kitar semula
Green technology and recycling
(Sebarang jawapan yang sesuai)
(Any suitable answer)

Bahagian C

5. (a) Botol A / *Bottle A*

- Suhu di dalam peti sejuk lebih rendah daripada suhu bilik.
Temperature in the refrigerator is lower than room temperature.
- Aktiviti bakteria lebih rendah.
Bacterial activity is lower.
- Kurang toksin yang dikeluarkan oleh bakteria. / Kadar susu menjadi rosak lebih rendah.
Less toxin is produced by bacteria. / The rate of milk spoilage is lower.

(b) (i) Set I: $\frac{50}{20} = 2.5 \text{ cm}^3 \text{ s}^{-1}$

Set II: $\frac{50}{15} = 3.33 \text{ cm}^3 \text{ s}^{-1}$

(ii) – Kadar tindak balas Set II lebih tinggi.
Rate of reaction of Set II is higher.

- Kuprum(II) sulfat ialah mangkin.
Copper(II) sulphate is a catalyst.
- Mangkin merendahkan tenaga pengaktifan.
Catalyst lowers the activation energy.
- Frekuensi perlanggaran berkesan lebih tinggi. / *Frequency of effective collisions is higher.*

(c) Bahan: Serbuk mangan(IV) oksida, 20-isi padu hidrogen peroksida
Materials: Manganese(IV) oxide powder, 20-volume hydrogen peroxide

Radas: Silinder penyukat 10 cm³, tabung uji, rak tabung uji, kayu uji
Apparatus: 10 cm³ measuring cylinder, test tube, test tube rack, wooden splinter

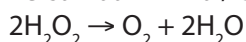
Pemboleh ubah dimanipulasikan: Kehadiran mangkin / *Manipulated variable: Presence of catalyst*
Pemboleh ubah bergerak balas: Kadar tindak balas / *Responding variable: Rate of reaction*

Pemboleh ubah dimalarkan: Jisim serbuk mangan(IV) oksida / Suhu / Isi padu hidrogen peroksida
Fixed variable: Mass of manganese(IV) oxide powder / Temperature / Volume of hydrogen peroxide

Prosedur / *Procedure:*

1. 5 cm³ hidrogen peroksida dituang ke dalam dua tabung uji yang dilabel sebagai A dan B. Kedua-dua tabung uji diletakkan pada rak tabung uji.
5 cm³ hydrogen peroxide is poured into two test-tubes labelled as A and B. Both test tubes are placed in a test tube rack.
2. 0.5 g serbuk mangan(IV) oksida dimasukkan ke dalam tabung uji A.
0.5 g manganese(IV) oxide powder is put into test tube A.
3. Kayu uji berbara didekatkan ke mulut tabung uji dengan segera.
A glowing splinter is placed into the mouth of both test tubes quickly.
4. Pemerhatian direkodkan.
Observation is recorded.

Persamaan kimia / *Chemical equation:*



6. (a)

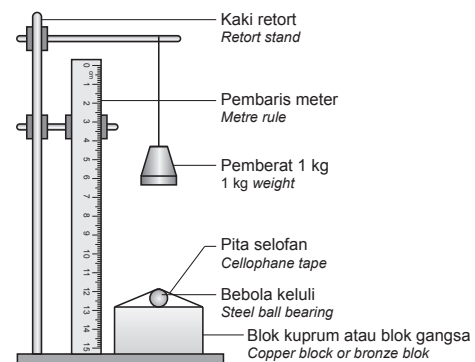
Bahan komposit <i>Composite material</i>	Jenis bahan komposit <i>Type of composite material</i>	Sifat Properties
R	Konkrit yang diperkukuhkan <i>Reinforced concrete</i>	Kekuatan mampatan yang tinggi / Kekuatan regangan yang tinggi / Tahan kakisan <i>High compression strength / High tensile strength / Corrosion resistance</i>
S	Kaca fotokromik <i>Photochromic glass</i>	Menyerap sinar UV / Sensitif terhadap keamatan cahaya <i>Absorbs UV rays / Sensitive to light intensity</i>

(b)

	Aloi X <i>Alloy X</i>	Aloi Y <i>Alloy Y</i>
Jenis aloi <i>Type of alloy</i>	Loyang <i>Brass</i>	Gangsa <i>Bronze</i>
Peratus komposisi <i>Percentage of composition</i>	70% kuprum <i>70% copper</i> 30% zink <i>30% zinc</i>	90% kuprum <i>90% copper</i> 10% stanum <i>10% tin</i>
Kegunaan Use	Alatan muzik / Tombol pintu / Kunci <i>Musical instruments / Door knobs / Locks</i>	Pingat / Tugu / Piala <i>Medals / Monuments / Trophies</i>

(c) Prosedur / *Procedure:*

1. Susunan radas seperti di bawah disediakan.
The apparatus set-up below is prepared.



2. Gantung pemberat 1 kg setinggi 80 cm di atas permukaan blok kuprum.
Hang 1 kg weight at 80 cm above the surface of the copper block.
3. Jatuhkan pemberat itu ke atas bebola keluli
Release the weight onto the steel ball bearing.
4. Ukur diameter lekuk yang terbentuk pada permukaan blok kuprum itu.
Measure the diameter of the dent formed on the surface of the copper block.
5. Ulang langkah 2 hingga 4 sebanyak tiga kali pada permukaan blok kuprum berbeza untuk memperoleh diameter purata lekuk.
Repeat steps 2 to 4 three times on different surfaces of the copper block to obtain the average diameter of the dent.
6. Ulang langkah 1 hingga 6 dengan menggantikan blok kuprum dengan blok loyang.
Repeat steps 1 to 6 by replacing the copper block with the bronze block.

Keputusan / Result :

Jenis blok Type of block	Diameter lekuk (cm) Diameter of dent (cm)				Purata diameter (cm) Average diameter (cm)
	1	2	3	4	
Kuprum Copper					
Gangsa Bronze					

Kesimpulan / Conclusion :

Gangsa adalah lebih keras berbanding kuprum. / Aloi lebih keras daripada logam tulennya.

Bronze is harder than copper. / Alloy is harder than its pure metal.

KERTAS 1

- | | | | | |
|-------|-------|-------|-------|-------|
| 1. A | 2. C | 3. C | 4. A | 5. C |
| 6. D | 7. A | 8. B | 9. B | 10. D |
| 11. C | 12. B | 13. C | 14. B | 15. A |
| 16. B | 17. A | 18. D | 19. B | 20. A |
| 21. D | 22. C | 23. B | 24. A | 25. B |
| 26. C | 27. B | 28. A | 29. B | 30. A |
| 31. C | 32. B | 33. D | 34. B | 35. D |
| 36. C | 37. B | 38. D | 39. D | 40. B |

KERTAS 2

Bahagian A

- (a) Bilangan proton dalam nukleus suatu atom.
Number of protons in the nucleus of an atom.

(b) ${}_{11}^{23}\text{Y} / {}_{11}^{23}\text{Na}$

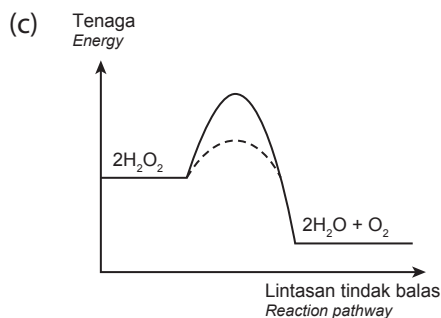
(c) 8

(d) (i) Pepejal kepada cecair
Solid to liquid

(ii) Berputar dan bergetar pada kedudukan yang tetap.
Rotate and vibrate at a fixed position.
- (a) Bertindak sebagai mangkin untuk meningkatkan kadar tindak balas.
Acts as a catalyst to increase the rate of reaction.

(b) • Zarah bahan tindak balas berlanggar pada orientasi yang betul.
Reactant particles collide in the correct orientations.

• Zarah bahan tindak balas mencapai tenaga pengaktifan.
Reactant particles achieve the activation energy.



- (d) 43.00 cm^3
- (a) (i) Campuran dua atau lebih unsur yang mana unsur utamanya ialah logam.
A mixture of two or more elements where its main element is a metal.

(ii) • Kromium / *Chromium*

• Nikel / *Nickel*

• Karbon / *Carbon*

[Mana-mana dua jawapan / *Any two answers*]

(iii) Jisim besi / *Mass of iron*

$$= \frac{71.5}{100} \times 2$$

$$= 1.43 \text{ kg}$$

(b) • Kaca borosilikat / *Borosilicate glass*

• Tahan haba / *Resistant to heat*
 - (a) Molekul / *Molecule*

(b) Bilangan mol CH_4
Number of moles of CH_4

$$= \frac{18}{24}$$

$$= 0.75 \text{ mol}$$

Bilangan molekul metana
Number of methane molecules

$$= 0.75 \times 6.02 \times 10^{23}$$

$$= 4.515 \times 10^{23}$$

(c) (i) $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$

(ii) • Bahan tindak balas ialah CH_4 dan O_2 .
Hasil tindak balas ialah CO_2 dan H_2O .
The reactants are CH_4 and O_2 . The products are CO_2 and H_2O .

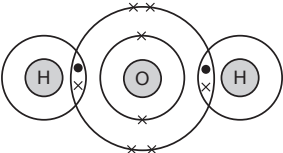
• 1 mol CH_4 bertindak balas dengan 2 mol O_2 untuk menghasilkan 1 mol CO_2 dan 2 mol H_2O .
1 mole of CH_4 reacts with 2 moles of O_2 to produce 1 moles of CO_2 and 2 moles of H_2O .
 - (a) Formula kimia yang menunjukkan nisbah paling ringkas atom setiap jenis unsur dalam sesuatu sebatian.
Chemical formula that shows the simplest ratio of the atoms of each type of element in a compound.

(b) (i) Magnesium oksida / Aluminium oksida / Zink oksida
Magnesium oxide / Aluminium oxide / Zinc oxide

- (ii) Plumbum(II) oksida / Kuprum(II) oksida
Lead(II) oxide / Copper(II) oxide

(c) (i)

Unsur <i>Element</i>	X	O
Bilangan mol <i>Number of moles</i>	$\frac{2.60}{65} = 0.04$	$\frac{0.64}{16} = 0.04$
Nisbah teringkas <i>Simplest ratio</i>	1	1
Formula empirik <i>Empirical formula</i>	XO	

- (ii) $2X + O_2 \rightarrow 2XO$
- (d) (i) Untuk mengelakkan plumbum // kuprum yang panas teroksida kepada plumbum(II) oksida // kuprum(II) oksida semula.
To prevent hot lead // copper from being oxidised to lead(II) oxide // copper(II) oxide again.
- (ii) Proses pemanasan, penyejukan dan penimbangan diulangi sehingga jisim yang tetap diperoleh.
Process of heating, cooling and weighing are repeated until a constant mass is obtained.
6. (a) (i) Ikatan ion / *Ionic bond*
- (ii) Daya tarikan elektrostatik antara ion-ion adalah kuat. / Lebih banyak haba diperlukan untuk mengatasi daya tarikan yang kuat antara ion-ion.
The electrostatic attraction forces between the ions is strong. / More heat is needed to overcome the strong attraction forces between ions.
- (b) (i) H dan O / *H and O*
- (ii)
- 
- (iii)
- Etanol larut di dalam sebatian kovalen X / air.
Ethanol dissolves in covalent compound X / water.
 - Molekul etanol mengandungi atom hidrogen yang terikat kepada atom oksigen.
Ethanol molecule contains hydrogen atom that is bonded to oxygen atom.
 - Molekul etanol membentuk ikatan hidrogen dengan molekul sebatian kovalen X / air.
Ethanol molecules form hydrogen bond with covalent compound X / water molecules.

(c) MgO

7. (a) Mengikut tertib menaik nombor proton
Ascending order of proton numbers

(b) Q, P, R, U, T, S

(c) (i) Bersifat bes
Basic

(ii) Bersifat amfoterik
Amphoteric

(d) (i) $2ROH + CO_2 \rightarrow R_2CO_3 + H_2O$

(ii) Bilangan mol CO_2
Number of moles of CO_2
 $= \frac{480}{24}$
 $= 20 \text{ mol}$

Nisbah mol / *Mole ratio*

2 mol ROH : 1 mol CO_2
 40 mol ROH : 20 mol CO_2

Jisim ROH / *Mass of ROH* = 40×24
 $= 960 \text{ g}$

- (e)
- Unsur Q / *Element Q*
 - Lengai secara kimia
Inert chemically

8. (a) (i) Larutan yang kepekatannya diketahui dengan tepat.

Solution which its concentration is accurately known.

(ii) $M_1V_1 = M_2V_2$
 $1.0 \times V_1 = 0.1 \times 250$
 $V_1 = 25 \text{ cm}^3$

(iii) 1. Keluarkan 25 cm^3 larutan natrium hidroksida 1.0 mol dm^{-3} dengan pipet.
Take out 25 cm^3 of 1.0 mol dm^{-3} sodium hydroxide solution with a pipette.

2. Pindahkan larutan ke dalam kelalang volumetrik 250 cm^3 .

Transfer the solution into 250 cm^3 volumetric flask.

3. Tambahkan air suling sehingga aras meniskus segaris dengan tanda senggatan.

Add distilled water until the meniscus level is aligned on the calibration mark.

(b) Bilangan mol NaOH
Number of moles of NaOH
 $= \frac{0.1 \times 25}{1000}$
 $= 0.0025 \text{ mol}$

Nisbah mol / *Mole ratio*

1 mol HCl : 1 mol NaOH
 $0.0025 \text{ mol HCl} : 0.0025 \text{ mol NaOH}$

Isi padu HCl
Volume of HCl

$$= \frac{0.0025 \times 1000}{0.1}$$

$$= 25.00 \text{ cm}^3$$

Atau / Or

$$\frac{M_a V_a}{M_b V_b} = \frac{a}{b}$$

$$\frac{0.1 \times V_a}{0.1 \times 25} = \frac{1}{1}$$

$$V_a = 25 \text{ cm}^3$$

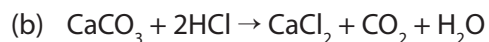
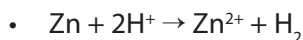
(c)

Kawasan A <i>Area A</i>	Kawasan B <i>Area B</i>
Sebab / Reason: Kualiti udara bersih <i>Clean air quality</i>	Sebab / Reason: Banyak peluang pekerjaan <i>Many job opportunities</i>
Hujan asid tidak berlaku <i>Acid rain does not occur</i>	Infrastruktur yang baik <i>Good infrastructures</i>

Bahagian B

9. (a) • Pelarut X: Air
Solvent X: Water
 • Pelarut Y: Metilbenzena / Propanon
Solvent Y: Methylbenzene / Propanone

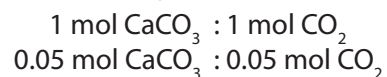
Larutan A <i>Solution A</i>	Larutan B <i>Solution B</i>
Gelembung gas terbebas <i>Gas bubbles released</i>	Tiada gelembung gas terbebas / Tiada perubahan <i>No bubbles released / No change</i>
HCl mengion <i>HCl ionised</i>	HCl tidak mengion / wujud sebagai molekul <i>HCl did not ionise / existed as molecules</i>
Menghasilkan ion H ⁺ / Menunjukkan sifat asid / Tindak balas berlaku <i>Produced H⁺ ions / Showed acidic properties / Reaction occurred</i>	Tiada ion H ⁺ dihasilkan / Tidak menunjukkan sifat asid / Tiada tindak balas berlaku <i>No H⁺ ion produced / Did not show acidic properties / No reaction occurred</i>



$$\text{Bilangan mol CO}_2 = \frac{1.2}{24}$$

$$\text{Number of moles of CO}_2 = 0.05 \text{ mol}$$

Nisbah mol / *Mole ratio*



Jisim CaCO₃ / *Mass of CaCO₃* = 0.05 × 100
 = 5 g

- (c) (i) • Q: Plumbum(II) iodida /
Lead(II) iodide // PbI₂
 • V: Karbon dioksida /
Carbon dioxide // CO₂
 • W: Plumbum(II) karbonat /
Lead(II) carbonate // PbCO₃
 • X: Asid nitrik / *Nitric acid // HNO₃*
 • Y: Plumbum(II) nitrat /
Lead(II) nitrate // Pb(NO₃)₂
 • Z: Plumbum(II) oksida /
Lead(II) oxide // PbO
- (ii) 1. Alirkan gas V ke dalam air kapur.
Pass gas V into limewater.
 2. Air kapur menjadi keruh.
Limewater turns cloudy.
10. (a) • Situasi I: Saiz garam batu
Situation I: Size of rock salt
 • Situasi II: Suhu air
Situation II: Temperature of water

Situasi I / *Situation I*

- Jumlah luas permukaan serbuk garam batu lebih besar berbanding dengan serpihan garam batu. / Saiz serbuk garam batu lebih kecil berbanding dengan serpihan garam batu.
The total surface area of rock salt powder is larger than rock salt flakes. / The size of rock salt powder is smaller than rock salt flakes.
- Luas permukaan serbuk garam batu yang terdedah kepada air lebih besar.
The surface area of rock salt powder exposed to water is larger.

Atau / Or

Situasi II / *Situation II*

- Suhu air panas lebih tinggi daripada air sejuk.
Temperature of hot water is higher than cold water.
- Tenaga kinetik molekul / zarah air lebih tinggi.
Kinetic energy of water molecules / particles is higher.

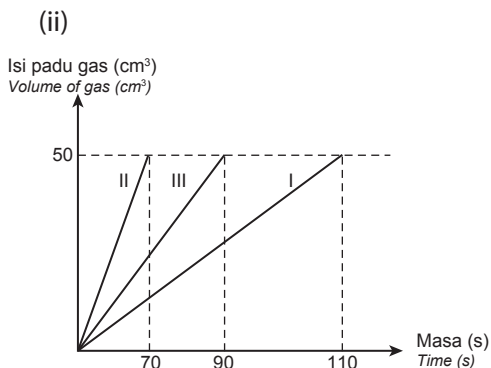
- (b) (i) • $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$
- Bilangan mol H_2O_4
Number of moles of H_2SO_4

$$= \frac{0.1 \times 50}{1000}$$

$$= 0.005 \text{ mol}$$
 - Isi padu gas H_2
Volume of H_2 gas

$$= 0.005 \times 24$$

$$= 0.12 \text{ dm}^3$$



(iii) **Set I dan Set II / Set I and Set II**

- Kadar tindak balas Set II lebih tinggi daripada Set I.
The rate of reaction in Set II is higher than Set I.
- Mangkin hadir di Set II.
Catalyst is present in Set II.
- Mangkin / CuSO_4 menyediakan lintasan alternatif dengan merendahkan tenaga pengaktifan.
Catalyst / CuSO_4 provides an alternative pathway by lowering the activation energy.
- Lebih banyak zarah-zarah bahan tindak balas / atom zink dan ion hidrogen mencapai / mengatasi tenaga pengaktifan yang lebih rendah.
More reactants particles / zinc atoms and hydrogen ions can achieve / overcome the lower activation energy.
- Frekuensi perlanggaran berkesan antara atom zink dan ion hidrogen dalam Set II lebih tinggi berbanding dengan Set I.
The frequency of effective collisions between zinc atoms and hydrogen ions in Set II is higher than Set I.

Set I dan Set III / Set I and Set III

- Kadar tindak balas dalam Set III lebih tinggi daripada Set I.
The rate of reaction in Set III is higher than Set I.
- Kepekatan asid sulfurik / ion hidrogen dalam Set III lebih tinggi daripada Set I.
The concentration of sulphuric acid / hydrogen ions in Set III is higher than Set I.
- Bilangan ion hidrogen per unit isi padu dalam Set III lebih tinggi daripada Set I.
The number of hydrogen ions per unit volume in Set III is higher than Set I.
- Frekuensi perlanggaran antara atom zink dan ion hidrogen dalam Set III lebih tinggi berbanding dengan Set I.
The frequency of collisions between zinc atoms and hydrogen ions in Set III is higher than Set I.
- Frekuensi perlanggaran berkesan dalam Set III lebih tinggi berbanding dengan Set I.
The frequency of effective collisions in Set III is higher than Set I.

Bahagian C

11. (a) (i) • W: Kaca soda kapur / Soda-lime glass
• X: Kaca fotokromik / Photochromic glass

Persamaan sifat kaca W dan kaca X
Similar properties of glass W and glass X

- Lut sinar / Transparent
- Lengai secara kimia / Inert chemically
- Penebat haba dan elektrik
Heat and electrical insulator
- Kalis air / Waterproof

[Mana-mana dua jawapan / Any two answers]

- (ii) • X / Kaca fotokromik / Photochromic glass
• Sensitif terhadap keamatan cahaya
Sensitive to light intensity
- Menyerap sinar ultraungu
Absorbs ultraviolet rays
- (b) • Bahan A / Material A: Gangsa / Bronze
Bahan B / Material B: Kuprum / Copper
- Kedalaman lekuk bahan A / gangsa adalah lebih kecil berbanding dengan bahan B / kuprum tulen.
The depth of dent of material A / bronze is smaller than material B / pure copper.

- Dalam bahan *A* / gangsa, kehadiran atom stanum dengan saiz yang berlainan mengganggu susunan teratur atom kuprum tulen.
Dalam bahan *B* / kuprum tulen, atom yang bersaiz sama disusun secara teratur.
In material A / bronze, the presence of tin atoms with different sizes disrupt the orderly arrangement of pure copper atoms.
In material B / pure copper, the atoms of the same size are arranged orderly.
- Apabila dikenakan daya, atom dalam bahan *A* / gangsa sukar menggelongsor, manakala atom dalam bahan *B* / kuprum tulen mudah menggelongsor.
When force is applied, the atoms in material A / bronze cannot slide easily, while the atoms in material B / pure copper can slide easily.
- Bahan *A* / Gangsa lebih keras / kuat berbanding dengan bahan *B* / kuprum tulen.
Material A / Bronze is harder / stronger than material B / pure copper.

- (c) (i)
- Keluli / *Steel*
 - Lebih kuat / Lebih keras / Lebih tahan kakisan / pengaratan
Stronger / Harder / More resistant to corrosion / rusting

- (ii)
1. Kepingan besi dan kepingan keluli dibersihkan dengan kertas pasir.
Iron plate and steel plate are cleaned with sandpaper.
 2. Dua bikar diisi dengan (20 – 100) cm³ air suling.
Two beakers are filled with (20 – 100) cm³ of distilled water.
 3. Kedua-dua kepingan diletakkan ke dalam setiap bikar.
Both plates are placed into each beaker.
 4. Kedua-dua bikar dibiarkan selama satu minggu.
Both beakers are left aside for one week.
 5. Pemerhatian dicatatkan.
The observation is recorded.
 6. Kepingan besi diselaputi dengan banyak pepejal perang, manakala kepingan keluli diselaputi dengan sedikit pepejal perang.
Iron plate is covered with a lot of brown solid, while steel plate is covered with a little of brown solid.