

# CHEMISTRY

## Format of Chemistry Paper SPM Level

PAPER	NO	ITEM	CONTENT
<b>PAPER ONE</b>	A	Types of instruments	Objective test
	B	Types of items	Objective item; multiple choice each item either three, four or five options- A,B and C, or A, B, C and D, or A, B, C, D and E
	C	Number of questions	50, answers all
	D	Total marks	50 marks ( 1 mark for 1 question)
	E	Duration of test	1 hour 15 minutes (75 minutes)
	F	Construct requirement	Construct requirement i. knowledge-25% to 45% ii understanding-35% to 45% iii Application of skills-30% to 35%
	G	Level of difficulty	Low-50%, Moderate-30%, High-20%
<b>PAPER TWO</b>	A	Types of instruments	Subjective test
		Types of items i Section A	Structured item-contains 6 questions, answer all questions.
		ii Section B iii. Section C	2 Questions (answer only one) 2 Questions (answer only one)
<b>PAPER THREE</b>		Types of instruments	Written practice test
		Types of question	-Structured questions -Essay questions
		Number of question	3 Questions (Answers all) - two structured questions - one open respond item
		Total marks	50 marks
		Time	1 hour 30 minutes
		Construct requirement	Problem solving: 100% (experimenting)
		Level of difficulty	Low-50%, Moderate-30%, High-20%

### Analysis of Chemistry Paper SPM Level

TOPICS  YEAR	PAPER 1			PAPER 2			PAPER 3		
	04	05	06	04	05	06	04	05	06
Form 4									
Introduction to chemistry									
The structure of the atom	7	6	6	2	½	1		1	
Chemical formulae and questions	4	6	6			1	1		
Periodic table of elements	2	3	3		1		1		
Chemical bonds	2	1	2			1			
Electrochemistry	2	3	5	1	2			½	
Acids and bases	5	4	3	1	2			½	
Salts	1	-	2						
Manufactured substances in industry	4	3	4	1		1		1	
Form 5									
Rate of reaction	4	5	4		1	1			
Carbon compounds	6	7	6	2					1
Oxidation and reduction	6	7	4	1					
Thermo chemistry	4	4	5	1	4				1
Chemical for consumer	2	1	2	1	1	1			



# CONTOH KERTAS SOALAN

# CHEMISTRY

PAPER 1

ONE HOUR FIFTEEN MINUTES

Instruction: Questions 1 to 50 are followed by four options A,B,C and D.

Choose the best option for each question and blacken the corresponding space on the objective answer sheet.

1. The most common chemicals used in our daily life is table salt. What is the chemical term for the table salt?

A. Potassium oxide      C. Potassium chloride  
B. Sodium chloride      D. Sodium oxide

2. Figure 1 shows the set-up of a simple cell

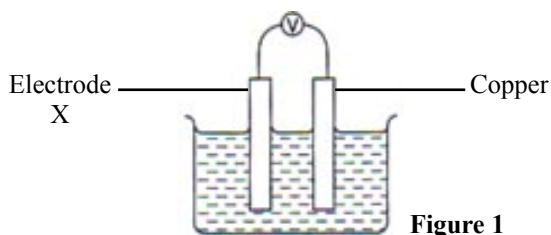


Figure 1

Which of the following metals will give the highest voltmeter reading when used as electrode X?

A. Iron      C. Tin  
B. Lead      D. Magnesium

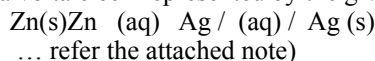
3. Acidic and basic properties are found in aluminum oxide, therefore it is \_\_\_\_ oxide.

A. an amphoteric      C. a metalloid  
B. an acid      D. a base

4. Which of the following uses of inert gases is wrongly paired?

A.	Helium	To fill meteorological balloons
B.	Radon	Decays to give X-rays which is used to destroy cancer cells
C.	Neon	To fill advertising electric bulbs
D.	Krypton	To fill flash bulb of cameras

5. Consider a voltaic cell represented by the given symbol:



What is the reaction that occur in the voltaic cell represented by the symbols above?

A. Electrons flow silver ions to zinc  
B. Zinc atoms receive electrons from silver ions  
C. Zinc is the reducing agent  
D. Silver ions release an electron to zinc

6. Figure 2 shows the set-up of experiment

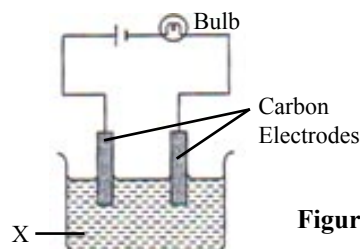


Figure 2

The bulb in figure 2 will light up if X is

A. lead nitrate solution  
B. solid sodium chloride  
C. molten phosphorus  
D. glucose

7. All the following affects the rate of reaction **except**

A. volume of reactant  
B. mass of reactant  
C. size of reactant  
D. temperature

8. Which of the following reactions occur very slowly at a room temperature?

A.  $\text{NH}_4\text{Cl}(\text{aq}) \rightarrow \text{NH}_3(\text{g}) + \text{HCl}(\text{aq})$   
B.  $\text{Zn}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{H}_2(\text{g})$   
C.  $2\text{H}_2\text{O}_2(\text{aq}) \rightarrow 2\text{H}_2\text{O} + \text{O}_2(\text{g})$   
D.  $\text{CaCO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CaCl}_2(\text{aq}) + \text{H}_2\text{O}(\text{aq}) + \text{CO}_2$

9. Which catalyst is used in the manufacturing industry of margarine?

A. Platinum      C. Iron  
B. Nickel      D. Copper

10. When the concentration in a reaction is increased, the rate of reaction is increased. This is because the...

A. number of reactant particles are increased  
B. collisions between the particles are increased  
C. effective collision is increased  
D. activation energy is reduced

11. The rate of reaction usually decreases if the time of reaction increases. This is because....

A. concentration of product increased  
B. concentration of reactant decreased  
C. the movement of particles is slower  
D. the activation energy increased



12. Mutton can be cooked faster if...
- cut into a small pieces
  - cooked with spices
  - cooked in a big pot
  - boiled with a lot of water
13.  $2\text{Fe}^{3+} + \text{Zn} \longrightarrow 2\text{Fe}^{2+} + \text{Zn}^{2+}$
- Which of the following is not true about the above redox reaction?
- Zinc is reducing agent
  - Fe ion is oxidizing agent
  - Oxidation number of iron decrease from +3 to +2
  - Electrons transfer from Fe to Zn
14.  $\text{Fe}^{2+} \longrightarrow \text{Fe}^{3+} + \text{e}$
- Which of the following chemicals can change  $\text{Fe}^{2+}$  to  $\text{Fe}^{3+}$
- Pottasium iodide solution
  - Acidic pottasium dichromate (VI)
  - Acidic pottasium manganate (VIII)
  - Pottasium thiocyanate
- I and II only
  - II and iv only
  - II, and III only
  - I, II, III, and IV
15. Which of the following chloride compounds dissolved in water?
- Silver chloride
  - Lead (III) chloride
  - Mercury chloride
  - Copper (II) chloride
16. The element Q has a proton number of 19. the chemical properties of element Q is predicted to have the same chemical properties with the element which has the proton numbers of
- 11
  - 13
  - 17
  - 20
17. Which of the following material is an ionic compound?
- |    | Melting point, °C | Boiling point, °C | Solubility in water |
|----|-------------------|-------------------|---------------------|
| A. | -7                | 59                | Soluble             |
| B. | -80               | 75                | Soluble             |
| C. | 800               | 1432              | Soluble             |
| D. | 1562              | 6720              | Not Soluble         |
18. Electrolyte used in lead-acid accumulator is
- ammonium chloride paste
  - dilute sulphuric acid
  - potassium hydroxide
  - mixture of zinc hydroxide and pottasium hydroxide
19. Which of the following are the advantages of mercury cell?
- Portable
  - Small in size
  - Gives a large current
  - Light
- I, II and IV only
  - I, III and IV only
  - II, III and IV only
  - I, II, III and IV
20. The electrochemical series is used to determine:
- The terminal of a cell
  - The standard cell voltage
  - The ability of a metal to displace another metal from its salt solution
  - To extract metal from its oxide
- I, II and III only
  - II and IV only
  - IV only
  - I, II, III and IV
21. The ionic formulae of elements X any Y are as follows:
- |                 |                 |
|-----------------|-----------------|
| $\text{X}^{3+}$ | $\text{Y}^{2+}$ |
|-----------------|-----------------|
- The compound reacts from the ions of elements X and Y with the formula of  $\text{X}_2\text{Y}_3$ .
- Which of the following ionic equations represents the reaction?
- $\text{X}^{3+} + \text{Y}^{2-} \longrightarrow \text{X}_2\text{Y}_3$
  - $2\text{X} + 3\text{Y} \longrightarrow \text{X}_2\text{Y}_3$
  - $2\text{X}^{3+} + 3\text{Y}^{2-} \longrightarrow \text{X}_2\text{Y}_3$
  - $3\text{X}^{3+} + 2\text{Y}^{2-} \longrightarrow \text{X}_2\text{Y}_3$
22. 3.2 g of copper(II) oxide powder reacts with excess dilute nitric acid. What is the mass of copper(II) nitrate formed in the reaction?  
(relative atomic mass of N= 14, O = 16 and Cu = 64)
- 3.76 g
  - 4.96 g
  - 5.04 g
  - 7.52 g
23. In an experiment between hydraulic acid and zinc produces 25cm<sup>3</sup> hydrogen gas. The reaction completes in 50 seconds. What is the average rate of the reaction?
- 0.5 cm<sup>3</sup> s<sup>-1</sup>
  - 1.0 cm<sup>3</sup> s<sup>-1</sup>
  - 2.0 cm<sup>3</sup> s<sup>-1</sup>
  - 4.0 cm<sup>3</sup> s<sup>-1</sup>
24. The following equation is the equation heptanes combustion,  $\text{C}_7\text{H}_{16}$ , in excess Oxygen.
- $$\text{C}_7\text{H}_{16(l)} + 11\text{O}_{2(g)} \longrightarrow 7\text{CO}_{2(g)} + 8\text{H}_2\text{O}$$
- H= -5 512 kJ mol<sup>-1</sup>
- The combustion of heptane in excess oxygen releases 1 378 kJ of energy. What is the mass of heptane used?(relative atomic mass of H=1, C=12)
- 25.0 g
  - 36.0 g
  - 77.0 g
  - 88.0 g



25. The table below is the information about three simple cells.

Pair of metals	Potential differences/V	Metal at negative terminal
X and copper	0.45	X
Y and copper	1.30	Y
Z and copper	0.56	Cu

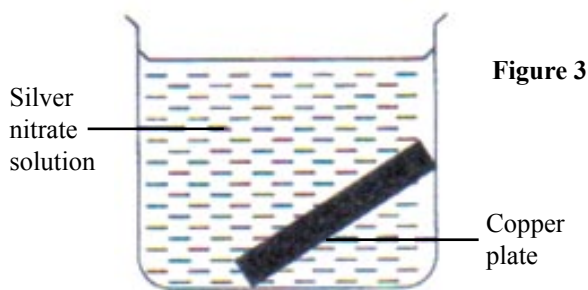
What is the potential difference of the pair of metals Y and Z?

- A. 0.85  
B. 1.01  
C. 1.86  
D. 2.31
26. The reactivity of the halogen can be determined by a reaction between halogen halide solution. The result of the reaction is shown in the table.

Halogen Halide Solution	Chlorine	Bromine	Iodine
Potassium Bromide	Reaction occurs		No reaction
Potassium iodide	Reaction occurs	Reaction occurs	

The reactivity series of halogen in descending order is

- A. bromine, chlorine, iodine  
B. chlorine, bromine, iodine  
C. iodine, bromine, chlorine  
D. iodine, chlorine, bromine
27. Which of the following reaction shows the oxidation of copper
- A. Reaction of zinc with copper (II) oxide  
B. Reaction of copper with silver nitrate solution  
C. Electrolysis of copper (II) sulphate solution by using carbon electrodes  
D. Chemical cell with copper and zinc electrodes in dilute sulphuric acid
28. Figure 3 shows the set-up apparatus for a displacement reaction.



What is observed after 10 minutes?

- A. Gas bubbles are released  
B. Brown deposits formed  
C. The solution turns blue  
D. The copper plate becomes thicker

29. Which of the following shows the increasing order of reactivity when an alkali metal reacts with chlorine?

- A. Rb, K, Na, Li  
B. Na, K, Li, Rb  
C. Li, Na, K, Rb  
D. Li, Na, Rb, K

30. Which of the following ions soluble in excess sodium hydroxide solution

- I  $\text{Al}^{3+}$   
II  $\text{Mg}^{2+}$   
III  $\text{Pb}^{2+}$   
IV  $\text{Zn}^{2+}$

- A. I and II only  
B. II and IV only  
C. I, II and III only  
D. I, II and IV only

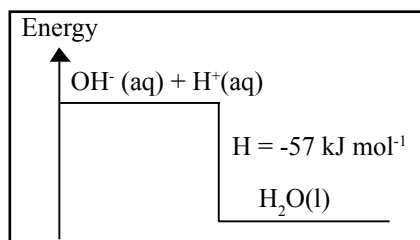
31. The information given shows the sub-atomic particles of atom W

- Electron configuration 2.1
- Number of protons 3
- Number of neutrons 4

Which of the following diagram shows an atom W?

- A. 3p + 4n
- B. 3p + 4n
- C. 3p + 3e
- D. 3p + 3e

- 32.



The diagram can be concluded that

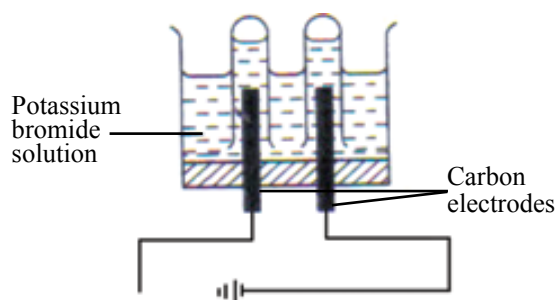
- A. the heat of neutralization is  $-57 \text{ kJ mol}^{-1}$   
B. 57 kJ of energy is needed for the reaction.  
C. the products contain more energy than the reactants.  
D. the temperature at the end of the reaction is lower than that at the beginning of the reaction

33. The result for three chemical cells are shown as in the table

Chemical cell	Metal pairs	Negative terminal	Cell voltage/V
X	P and R	R	1.9
Y	R and S	S	0.8
Z	Q and R	R	0.3

Which of the following can be deduced from Table 3?

- I. The cell voltage is 1.6 V when P and Q are used as electrodes.  
 II. The cell voltage is 1.1 V when P and S are used as electrode.  
 III. Electrons flow from terminal Q to terminal S in the metal pair Q and S  
 IV. P functions as a positive terminal when it is paired with Q, R, or S in a cell
- A. I and IV only                      C. I, II, and III only  
 B. II and III only                    D. I, II, III and IV
34. Brass is harder than ferrum because
- A. the bond between the atoms of brass is stronger  
 B. the arrangement of atoms in brass is more compact  
 C. the atoms of brass are harder to compressed  
 D. the layers of atoms in brass d not slide easily over one another
35. Ethanol is boiled in acidic potassium manganate(VII) to produce substance, X. substance X is refluxed with ethanol to produce compound Y. compound Y is
- A. ethanoic acid                      C. ethyl methanoate  
 B. ethyl ethanoate                    D. ethane
36. The products at anode and cathode each are



	Anode	Cathode
A.	Oxygen	Hydrogen
B.	Oxygen	Potassium
C.	Bromine	Hydrogen
D.	Bromine	Potassium

37. The reaction between etanoic acid and ethanol produces compound K. which of the following are true about compound K?

I it is sweet-smelling  
 II it is insoluble in water  
 III it has a low boiling point  
 IV its molecular formula is  $\text{CH}_3\text{COOCH}_3$

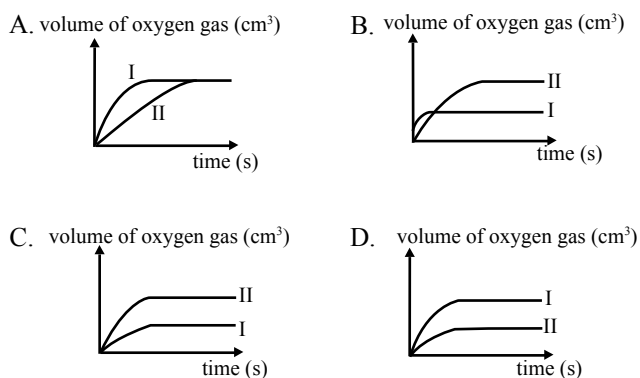
- A. I and II only                      C. I, II and IV only  
 B. I, II and III only                D. I, II, III and IV
38. Which of the following compound is added to processed meat as an antioxidant?
- A. Sodium Chloride  
 B. Sodium benzoate  
 C. Sodium nitrate  
 D. Sodium acetate
39. Astatine is below iodine in group 17 of the Periodic Table. Which of the following are likely to be true about astatine?
- I it is a solid at room temperature  
 II it forms diatomic molecules  
 III it forms  $\text{At}^-$  ion  
 IV it reacts with sodium to form a white compound
- A. I, II and III only                C. II, III and IV only  
 B. I, III, and IV only              D. I, II, III and IV
40. The reaction between calcium carbonate and sulphuric acid produces carbon dioxide gas. Which of the following pairs of reactants will have the highest initial rate of production of carbon dioxide gas?
- A. 50cm<sup>3</sup> of 2.0 dm<sup>-3</sup> sulphuric acid and 2g of calcium carbonate powder  
 B. 30cm<sup>3</sup> of 2.0 dm<sup>-3</sup> sulphuric acid and 2g of calcium carbonate pellets  
 C. 100cm<sup>3</sup> of 2.0 dm<sup>-3</sup> sulphuric acid and 2g of calcium carbonate powder  
 D. 20cm<sup>3</sup> of 2.0 dm<sup>-3</sup> sulphuric acid and 2g of calcium carbonate powder
41. Carbon and sulphur reacts according to the equation given below
- $$\text{C}_{(s)} + 2\text{S}_{(s)} \longrightarrow \text{CS}_2(l), H = +88 \text{ kJ mol}^{-1}$$
- Which of the following statements is true according to the equation. [ relative atomic mass; C, 12 , S, 32]
- A. the breaking of bonds in carbon and sulphur absorbs 88kJ  
 B. formation of 1 mol of carbon disulphide releases 88 kJ  
 C. reaction of 32g of sulphur absorbs 88 kJ  
 D. reaction of 6g of carbon absorbs 44 kJ



42. The table shows the conditions of two experiments carried out to investigate the rate of decomposition of hydrogen peroxide catalysed by manganate (IV) oxide.

Experiment	Mass of manganate(IV) oxide	Hydrogen peroxide solution
I	0.5 g	100 cm <sup>3</sup> 1.0 mol dm <sup>-3</sup>
II	0.5 g	400 cm <sup>3</sup> 0.5 mol dm <sup>-3</sup>

Which of the following graphs is that of the results obtained from experiments I and II?



43. The tables shows the proton numbers of four elements; E, F, H and I

Element	E	F	H	I
Proton number	2	4	12	16

Which of the following pairs of elements will form a compound with a high melting point?

- A. E and H  
B. E and I  
C. F and H  
D. H and I
44. The electron arrangement of atom X is 2.8.5. which of the following statements are true about atom X?
- I The nucleon number of X is 15.  
II X has 15 nucleons in its nucleus  
III X forms a covalent compound with hydrogen  
IV The compound formed by X and chlorine has the empirical formula XCl<sub>3</sub>
- A. I and II only  
B. III and IV only  
C. II and IV only  
D. II, III, and IV only

45. Which of the following oxides will dissolve in water to produce a solution with a pH of less than 7?

- I Magnesium oxide  
II Silicon dioxide  
III Phosphorus pentoxide  
IV Sulphur dioxide

- A. I and II only  
B. II and IV only  
C. III and IV only  
D. II, III and IV only

46. When powdered calcium carbonate reacts with dilute hydrochloric acid, the carbon dioxide gas is produced. If the complete reaction of calcium carbonate with dilute hydrochloric acid produces a maximum volume of 30cm<sup>3</sup> of carbon dioxide gas in 100 seconds, what is the average rate of this reaction?

- A. 0.1 cm<sup>3</sup>s<sup>-1</sup>  
B. 0.3 cm<sup>3</sup>s<sup>-1</sup>  
C. 0.6 cm<sup>3</sup>s<sup>-1</sup>  
D. 0.9 cm<sup>3</sup>s<sup>-1</sup>

47. Figure 4 shows the set-up of an apparatus used to prepare a carbon compound.

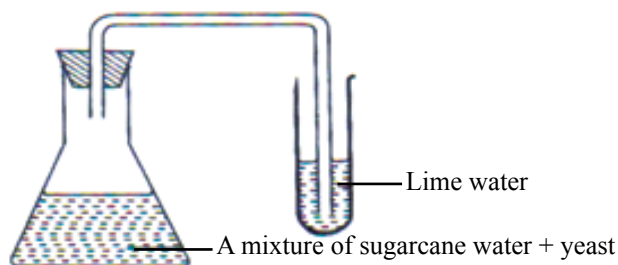
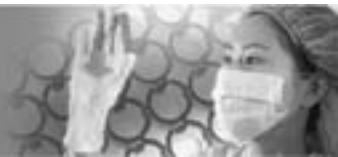


Figure 4

The carbon compound that is produced

- A. burns with a sooty flame  
B. does not dissolve in water  
C. has a double bond in its structural formula  
D. can decolourise and acidified potassium manganate (VII) solution



48. Which of the following describes the properties of hydrogen chloride?
- I This gas can dissolve in water and turns damp blue litmus paper to red
  - II This gas contain hydroxonium ions
  - III this gas burns the skin if it is in contact with it
  - IV This gas is only made up of covalent molecules
- A. I and II only                      C. II and III only  
B. I and IV only                      D. II and IV only
49. Which of the following is a characteristic of copper?
- I It can conduct electricity in both solid and molten states
  - II it has strong ionic bonds
  - III It has a high boiling point
  - IV It has an oxidation number of +2
- A. I and II only                      C. II and IV only  
B. I and III only                      D. I, III and IV only
50. When exposed to air, fats and oils will be oxidised. Name the food additives used to prevent oxidation from occurring.
- A. Preservatives                      C. Antioxidants  
B. Stabilisers                      D. Thickeners





PAPER 2  
TWO HOURS AND THIRTY MINUTES  
Section A  
[60 marks]

Answer all questions in the section. The time suggested to complete **Section A is 90 minutes.**

1. Table 1 shows four substances and their respective formulae

Substances	Chemical Formulae
Iodine	$I_2$
Copper	Cu
Naphthalene	$C_{10}H_8$
Copper(II) Sulphate	$CuSO_4$

Table 1

- a) Use information from Table 1 to answer the following questions.

- (i) State one substance from Table 1 which exist as molecules

\_\_\_\_\_ [1 mark]

- (ii) Which substance has the highest melting point, iodine, copper or naphthalene?

\_\_\_\_\_ [1 mark]

- (iii) What is the state of matter of copper (II) sulphate at room temperature?

\_\_\_\_\_ [1 mark]

- (iv) State the substance in Table 1 which can conduct electricity in the solid state.

\_\_\_\_\_ [1 mark]

- (v) Draw the arrangement of particles in the substance in (a) (iv).



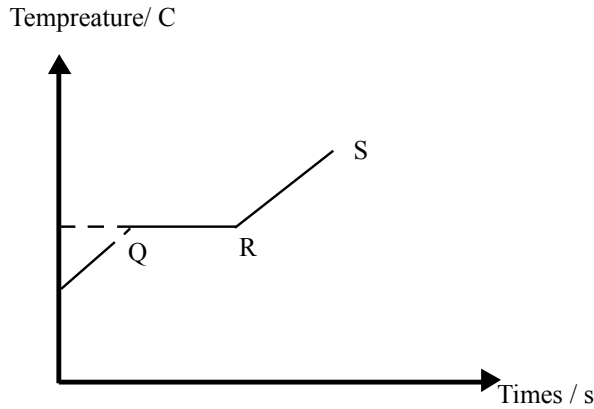
[2 marks]

- (vi) Write the chemical formulae for the substance in (a) (iv)

\_\_\_\_\_ [1 mark]



(b) Graph 1.1 shows the temperature against time when solid naphthalene is heated.



Graph 1.1

(i) State the melting point of naphthalene.

\_\_\_\_\_ [1 mark]

(ii) Explain why there is no change in temperature from Q to R.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3 marks]

(iii) State how the movement of naphthalene particles changes between R and S during the heating.

\_\_\_\_\_  
\_\_\_\_\_ [1 mark]



Figure 1

(a) Write the electron arrangement of  $\begin{matrix} 23 \\ \text{Na} \\ 11 \end{matrix}$ .

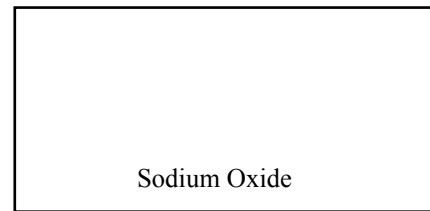
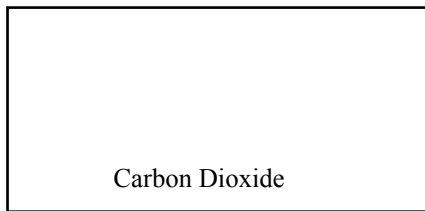
\_\_\_\_\_ [1 mark]

(b) Write the symbol of an isotope of carbon.

\_\_\_\_\_ [1 mark]



- (c) Using the dot and cross method, draw the electron arrangement of carbon dioxide and sodium dioxide to show the bonds formed in them.



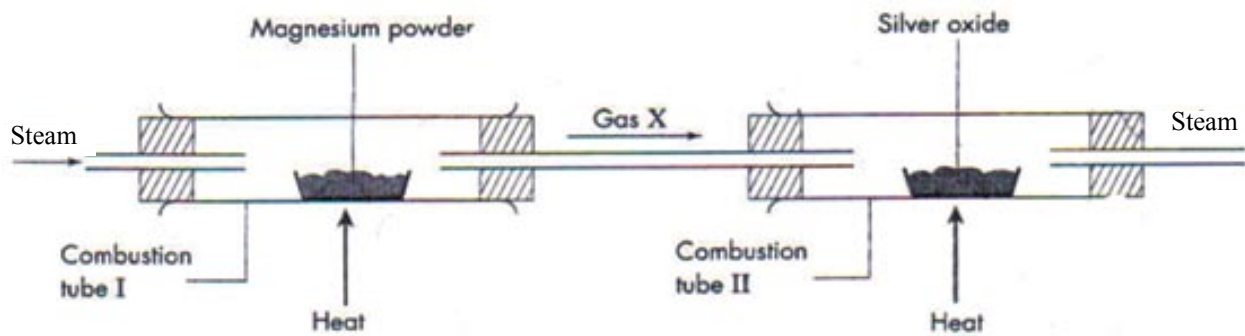
- (d) Between carbon dioxide and sodium oxide, which is acidic and basic?

\_\_\_\_\_ [2 marks]

- (e) State two differences in the physical properties of carbon dioxide and sodium oxide.

\_\_\_\_\_  
 \_\_\_\_\_ [2 marks]

3. Diagram below shows the set-up of apparatus to investigate the redox reaction in a chemical cell.



- (a) State the redox reaction in Combustion tube I

- (i) State the observations made in the two combustion tubes.

I: \_\_\_\_\_

II: \_\_\_\_\_ [2 marks]

- (b) Write the equation for the reaction occurred in combustion tube I.

\_\_\_\_\_ [1 mark]

- (c) (i) Name gas X

\_\_\_\_\_ [1 mark]

- (ii) Explain the production of gas X

\_\_\_\_\_ [1 mark]



(d) Calculate the mass of the substance produced in combustion tube 1 when 2.4 g of magnesium powder is reacted in excess steam flow. [ Relative atomic mass: H,1;O,16;Mg, 24] [2 marks]

(e) Write the equation for the reaction occurred in combustion tube II. [1 mark]

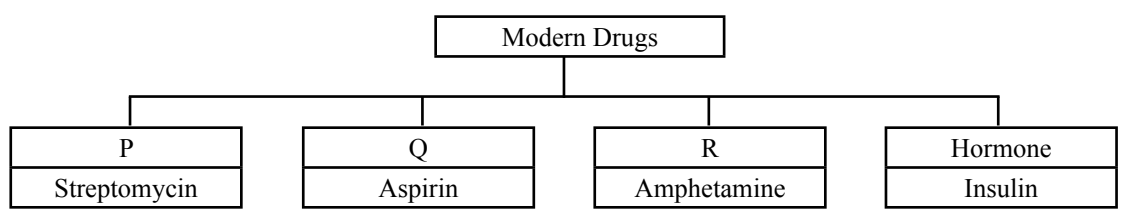
\_\_\_\_\_

(f) Name the substance that acts as an oxidizing agent in each combustion tube.

I: \_\_\_\_\_

II: \_\_\_\_\_ [2 marks]

4. The diagram is classification of drugs



(a) Name the type of drugs P,Q and R

P \_\_\_\_\_

Q \_\_\_\_\_

R \_\_\_\_\_ [3 marks]

(b) Explain the function of the respective drugs

P \_\_\_\_\_

Q \_\_\_\_\_

R \_\_\_\_\_ [3 marks]

(c) Why streptomycin must be taken constantly even after recovering from illness?

\_\_\_\_\_ [1 mark]

d) What is the disadvantage of taking aspirin?

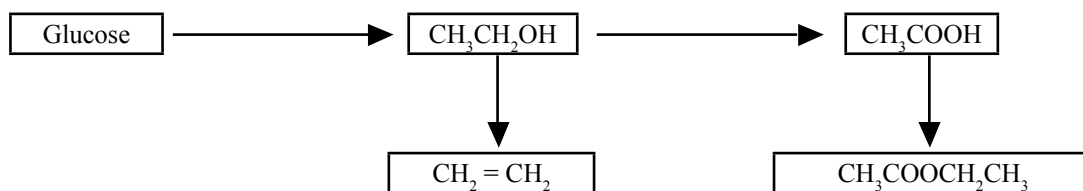
\_\_\_\_\_ [1 mark]

e) State the function of insulin

\_\_\_\_\_ [1 mark]

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5. Study the diagram given. It shows the conversion of a few organic compounds beginning from glucose.



(a) What is process I?

---

[1 mark]

(b)

i. Write an equation for the reaction which occurs in process II

---

[1 mark]

ii. Name the enzyme used in process II

---

[1 mark]

(c)

i. Write a balanced chemical equation for the reaction that occurs in process III

---

[1 mark]

ii. Name the reagent used in process III

---

[1 mark]

iii. Name the reaction that occurs in process III

---

[1 mark]

(d)

i. Name the reaction and the catalyst that are required in process IV

---

[2 marks]

ii. What is a physical property of the product formed in process IV?

---

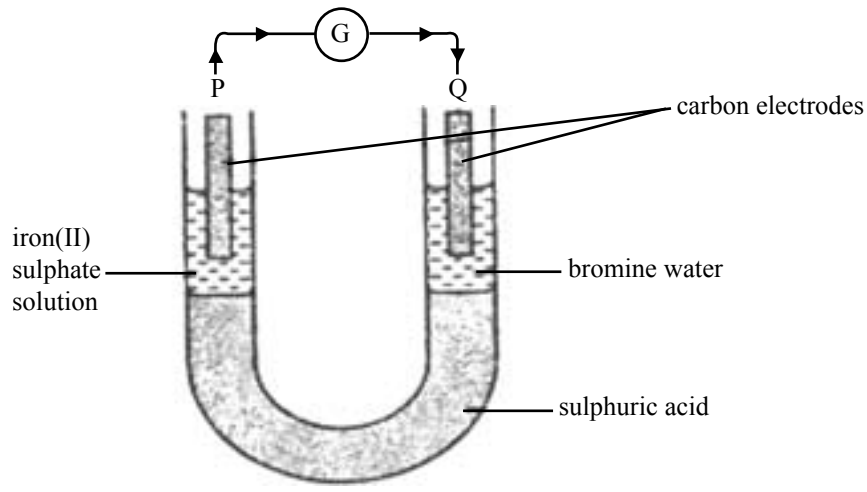
[2 marks]

iii. Name the homologous series of the process IV

---

[1 mark]

6. The diagram is the set-up apparatus showing the transfer of electrons at a distance between bromine water and iron (II) sulphate solution



(a) Mark the flow of electrons in the diagram

\_\_\_\_\_ [2 marks]

(b) Write the change in oxidation number of  
(i) bromine in bromine solution

\_\_\_\_\_ [1 mark]

(ii) iron in iron (II) sulphate solution

\_\_\_\_\_ [1 mark]

(c) Suggest how to confirm the presence of the product formed at electrode P

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3 marks]

(d) Name the substance that is reduced and oxidized in the reaction:

(i) reduced : \_\_\_\_\_

(ii) oxidized : \_\_\_\_\_

[3 marks]

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**Section B**  
[20 marks]

Answer any one question in this section. The time given to answer is 30 minutes.

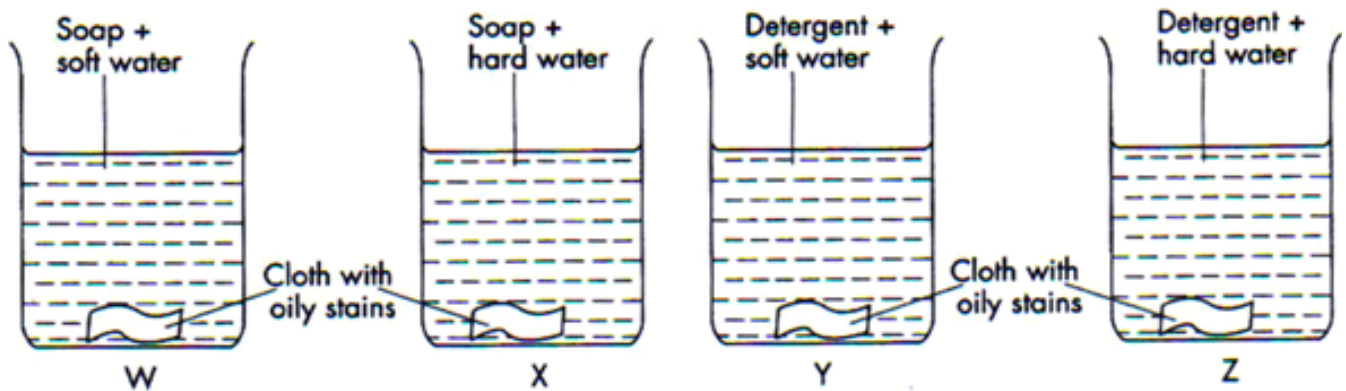
7. (a)

A container with oil stains is washed with soap

Explain the cleaning action of the soap on the oily stains.

[8 marks]

(b) A student conducted four experiments to study the cleaning effects of soap and detergent in soft water and hard water. The diagram shows the set-up of the experiment.



The observations made in the experiments are recorded in Table 3 below.

Experiment	W	X	Y	Z
Observation	Oily stains disappeared	Oily stains remained	Oily stains disappeared	Oily stains disappeared

Compare the cleaning effects between

- (i) Experiment W and Experiment X
- (ii) Experiment X and Experiment Z

Why are there differences in the observations? Explain your answer; state the substances that is more suitable as a cleaning agent to remove oily stains

[8 marks]

(c) gives **two** advantages and two disadvantages of using detergents

[4 marks]

8. (a) Describe the haber process in the manufacture of ammonia

[6 marks]

(b) Describe an experiment to prepare ammonium sulphate fertilizer in the laboratory

[9 marks]

(c) List the uses of ammonium in daily life

[5 marks]



**Section C**  
[20 marks]

Answer any one question in this section. The time given to answer is 30 minutes.

9. (a) You have an iron key that rusts easily.  
State how you would solve this problem using an electrolysis process [4 marks]
- (b) Electrolysis is carried out on a dilute sodium chloride solution using carbon electrodes.  
Explain how this electrolysis occurs. Use a labeled diagram to explain your answer. [6 marks]
- (c) Aluminum is placed above zinc in the electrochemical series.  
Aluminum and zinc can be used to build a chemical cell, using suitable apparatus and the following chemicals;

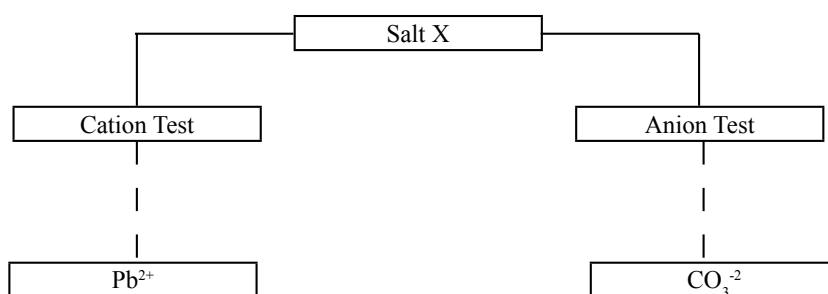
*Aluminum sulphate solution*  
*Zinc sulphate solution*  
*Sulphuric acid solution*

Describe how you built this chemical cell  
Include a labeled diagram in your answer.

On your diagram, mark the direction of the electron flow, the positive and the negative terminal.

[10 marks]

10. (a) A farmer discovered that his vegetables were not growing well because the soil was poor and acidic. As a chemistry student, you can help the farmer. Suggest how the farmer can solve the problem [2 marks]
- (b) Figure 8 shows an incomplete flow chart of cation and anion tests for salts X.



Use the reagents listed below and complete the flow chart to confirm that salt X contains  $\text{Pb}^{2+}$  ions and  $\text{CO}_3^{2-}$  ions. Include your observations.

**REAGENTS**

Dilute hydrochloric acid, dilute nitric acid, and lime water

[8 marks]

- (c) You are required to prepare dry magnesium chloride salt. The chemicals supplied are

- Magnesium sulphate solutions
- Dilute hydrochloric acid
- Potassium carbonate solution.

Describe a laboratory experiment to prepare the salt. In your description, include the chemical equations involved

[10 marks]

**PAPER 3**  
**Time: One hour and thirty minutes**  
 [50 marks]  
**Answer all questions.**

1. An experiment was carried out to examine the effect of temperature on the rate of reaction.

50 cm<sup>3</sup> of 0.05 mol/dm<sup>3</sup> sodium thiosulphate solution at 30 °C was put into a 250 cm<sup>3</sup> conical flask. The flask was then placed on an 'X' sign drawn on a piece of white paper. 10 cm<sup>3</sup> of 1 mol/dm<sup>3</sup> hydrochloric acid was added to the sodium thiosulphate solution, and the mixture was then shaken. At the same time, the stopwatch was started. The stopwatch was stopped once the 'X' sign disappeared.

The steps were repeated using sodium thiosulphate solution heated to 36 °C, 42 °C, 48 °C and 54 °C.

Figure 1 shows the readings on the stopwatch for each reaction.



Times,  $t_1 =$  \_\_\_\_\_ s  
 at 30°C



Times,  $t_2 =$  \_\_\_\_\_ s  
 at 36°C



Times,  $t_3 =$  \_\_\_\_\_ s  
 at 42°C



Times,  $t_4 =$  \_\_\_\_\_ s  
 at 48°C



Times,  $t_5 =$  \_\_\_\_\_ s  
 at 54°C

**Figure 1**

(a) Record the time for each reaction.

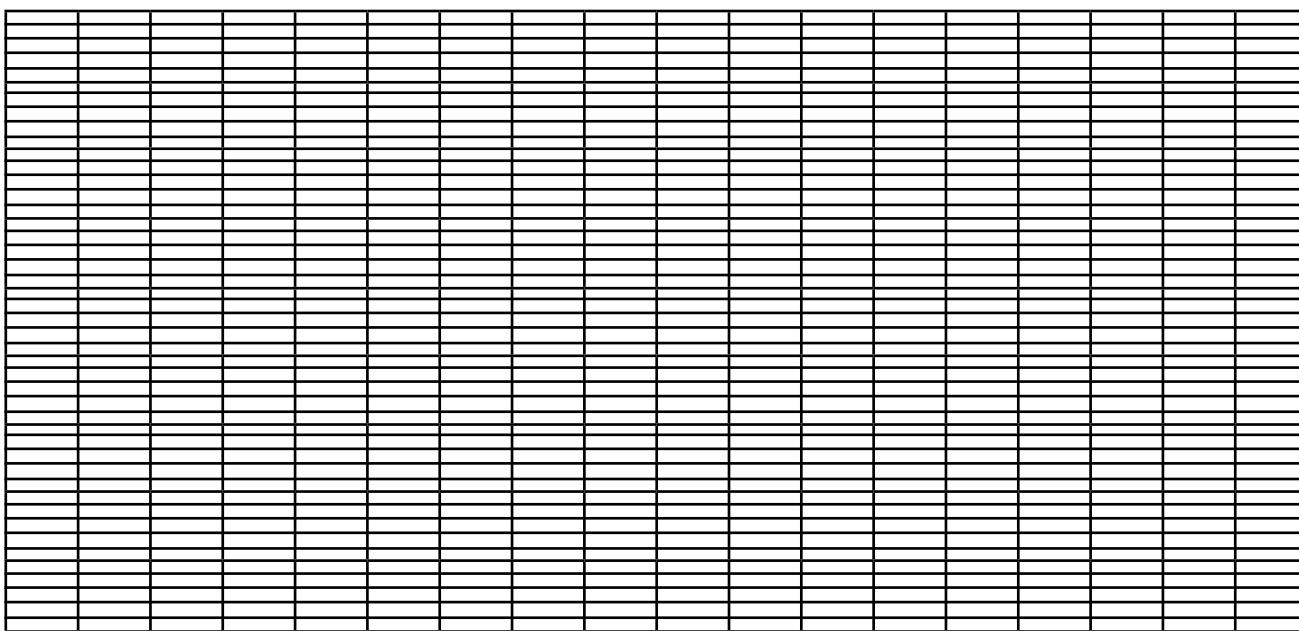
[3 marks]

(b) Construct a table and record the temperature, time and  $\frac{1}{\text{time}}$  for this experiment.

[3 marks]

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- (c) (i) Plot a graph of temperature against  $\frac{1}{\text{time}}$  on the graph paper below.



[3 marks]

- (ii) Based on your graph in (c) (i), state the relationship between the rate of reaction and temperature.

\_\_\_\_\_

[1 mark]

- (d) Predict the time when the 'X' sign disappear if the experiment is repeated at 60 °C.

\_\_\_\_\_

[1 mark]

- (e) State the hypothesis of this experiment.

\_\_\_\_\_

[1 mark]

- (f) (i) State the variables involved in this experiment.

Manipulated variable: \_\_\_\_\_

Responding variable : \_\_\_\_\_

Constant variable : \_\_\_\_\_

\_\_\_\_\_

[3 marks]

- (ii) Explain how you would manipulate one variable while keeping the other variables constant.

\_\_\_\_\_

\_\_\_\_\_

[1 mark]

- (g) The relationship between temperature and the rate of reaction is applied in our daily life, for example in keeping perishables like fish in refrigerator.

Using your knowledge in chemistry, state the relationship between temperature and the rate at which food turns spoiled.

\_\_\_\_\_

[1 mark]



2. The following apparatus is set up in an experiment determine the heat of neutralization between dilute hydrochloric acid and aqueous sodium hydroxide

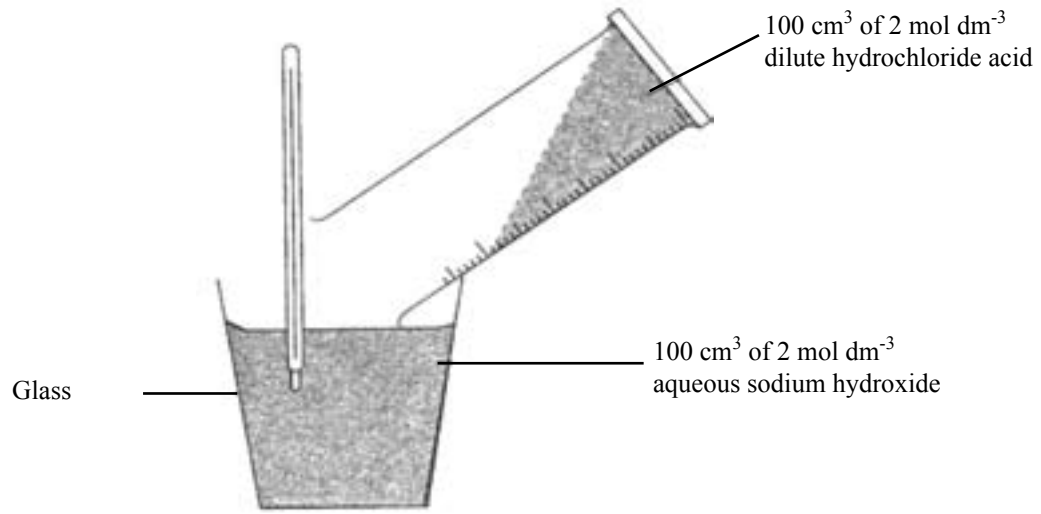


Figure 2 (a)

The initial temperatures of the two reactants and the maximum temperature of the mixture are shown by the thermometer readings in figure 2 (b).

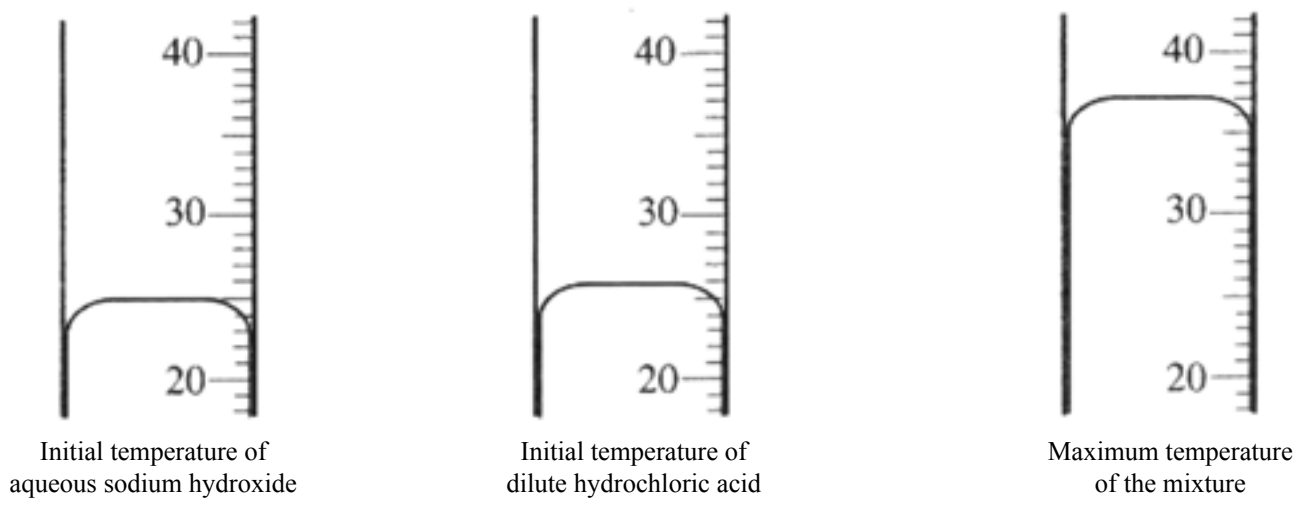


Figure 2 (b)

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(a) Based on the diagrams given in figure 2 (b), write down the temperature of each of the solutions in the appropriate spaces in table 3.

Initial temperature of aqueous sodium hydroxide/ $^{\circ}\text{C}$	
Initial temperature of dilute hydrochloric acid/ $^{\circ}\text{C}$	
Maximum temperature of the mixture/ $^{\circ}\text{C}$	

**Table 3**

[3 marks]

(b) i. Write the ionic equation for this neutralization reaction

\_\_\_\_\_

[1 mark]

ii. Calculate the total energy released in this reaction.

[ the specific heat capacity of water =  $4.2 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$ ; Density of the solution =  $1.0 \text{ g cm}^{-3}$ ]

[2 marks]

(c) i. Calculate the heat of neutralization for the reaction

[2 marks]



ii. Draw the energy level diagram for this reaction

[3 marks]

(d) i. state the observation of this experiment other than the changes in temperature.

\_\_\_\_\_ [1 mark]

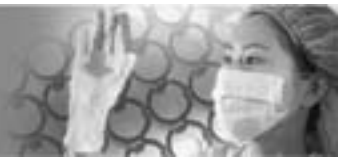
ii. State the inference from i.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2 marks]

(e) State the safety precautions to be taken up in this experiment.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3 marks]

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3.

Lorry tyres made from natural rubber have been modified so that the tyres can be used to last a distance of 60 000 km. The raw rubber material used has gone through a process called vulcanization.

Based on the above statement, describe an experiment on how you would compare the properties of vulcanized rubber from latex and also include the following aspects.

- a) Objective of the experiment
- b) Statement of the hypothesis
- c) List of materials and apparatus
- d) Methods of the experiment
- e) Tabulated data of the experiment

[17 marks]

