2017-DSE
CHEM

PAPER 1A

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2017

CHEMISTRY PAPER 1

8.30 am – 11.00 am (2 hours 30 minutes)

This paper must be answered in English

GENERAL INSTRUCTIONS

1. There are **TWO** sections, A and B, in this Paper. You are advised to finish Section A in about 45 minutes.

2. Section A consists of multiple-choice questions in this question paper, while Section B contains conventional questions printed separately in Question-Answer Book **B**.

3. Answers to Section A should be marked on the Multiple-choice Answer Sheet while answers to Section B should be written in the spaces provided in Question-Answer Book **B**. **The Answer Sheet for Section A and the Question-Answer Book for Section B will be collected separately at the end of the examination.**

4. A Periodic Table is printed on page 20 of Question-Answer Book **B**. Atomic numbers and relative atomic masses of elements can be obtained from the Periodic Table.

INSTRUCTIONS FOR SECTION A (MULTIPLE-CHOICE QUESTIONS)

1. Read carefully the instructions on the Answer Sheet. After the announcement of the start of the examination, you should first stick a barcode label and insert the information required in the spaces provided. No extra time will be given for sticking on the barcode label after the 'Time is up' announcement.

2. When told to open this book, you should check that all the questions are there. Look for the words **'END OF SECTION A'** after the last question.

3. All questions carry equal marks.

4. **ANSWER ALL QUESTIONS.** You are advised to use an HB pencil to mark all the answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured.

5. You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.

6. No marks will be deducted for wrong answers.

Not to be taken away before the
end of the examination session

This section consists of two parts. There are 24 questions in PART I and 12 questions in PART II.

Choose the best answer for each question.

Candidates may refer to the Periodic Table printed on page 20 of Question-Answer Book B.

PART I

1. Elements **X** and **Y** form an ionic compound with chemical formula $\mathbf{X_2Y}$. If the ion of **X** and the ion of **Y** have the same electronic arrangement, which of the following may this compound be ?

   A. lithium oxide
   B. aluminium oxide
   C. potassium sulphide
   D. magnesium chloride

2. Which of the following statements concerning hydrochloric acid is INCORRECT ?

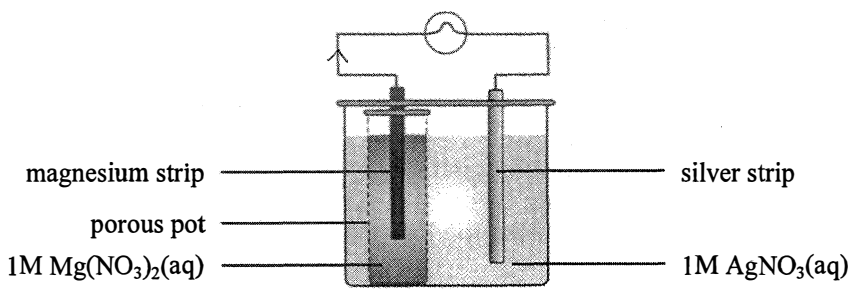
   A. It is a mineral acid.
   B. It completely ionises in water.
   C. It contains aqueous hydrogen ions.
   D. It does not contain aqueous hydroxide ions.

3. A hydrocarbon burns completely in oxygen to give 17.6 g of carbon dioxide and 3.6 g of water. Which of the following is the empirical formula of the hydrocarbon ?

   (Relative atomic masses: H = 1.0, C = 12.0, O = 16.0)

   A. CH
   B. CH_2
   C. C_2H_2
   D. C_2H_5

4. The diagram below shows a set-up with the bulb lights up :



   Which of the following statements concerning the set-up is correct ?

   A. Silver ions migrate towards the porous pot.
   B. The mass of the magnesium strip decreases.
   C. Heat energy is converted into electrical energy.
   D. Hydrogen ions are discharged on the silver strip.

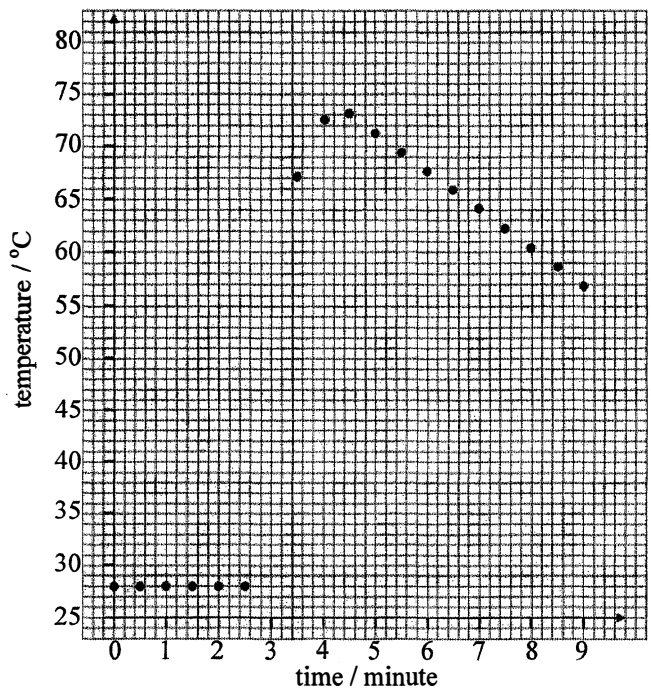
5. What is the systematic name of $Cl_2CH–CH=CH–CH=CH_2$?

A. 1-dichloropenta-2,4-diene
B. 5,5-chloropenta-1,3-diene
C. 1,1-dichloropenta-2,4-diene
D. 5,5-dichloropenta-1,3-diene

6. Which of the following is NOT the appropriate substance for preparing magnesium sulphate by directly mixing it with dilute sulphuric acid ?

A. magnesium metal
B. magnesium oxide
C. magnesium nitrate
D. magnesium carbonate

7. In an experiment for studying the enthalpy change of a reaction, the variation of the temperature of the content in the reaction container with time was plotted in a graph as shown below



The reaction starts at the third minute. Which of the following combinations is correct ?

	The greatest temperature rise of the content	Enthalpy change of the reaction
A.	51°C	negative
B.	45°C	negative
C.	51°C	positive
D.	45°C	positive

8. Which of the following statements concerning hydrogen-oxygen fuel cell is INCORRECT ?

A. It contains a catalyst.
B. Water is formed during discharge.
C. Oxygen gas is passed to the anode.
D. Hydrogen gas acts as the reducing agent.

9. Which of the following processes would NOT produce metal ?

A. heating zinc oxide
B. heating copper(II) oxide with carbon
C. electrolysis of molten lithium chloride
D. heating iron(III) oxide with carbon monoxide

10. Calcium phosphate is insoluble in water. What is the theoretical number of moles of calcium phosphate obtained when 100.0 cm^3 of 0.30 mol dm^{-3} $CaCl_2(aq)$ is mixed with 300.0 cm^3 of 0.10 mol dm^{-3} $Na_3PO_4(aq)$?

(Relative atomic masses: O = 16.0, Na = 23.0, P = 31.0, Cl = 35.5, Ca = 40.1)

A. 0.010
B. 0.015
C. 0.020
D. 0.030

11. Which of the following statements concerning zinc is correct ?

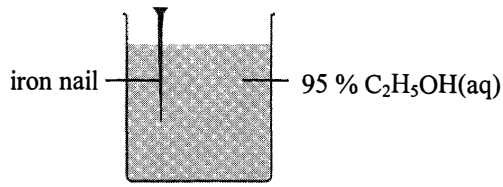
A. It forms a soluble oxide when placed in $NH_3(aq)$.
B. It acts as a reducing agent when placed in HCl(aq).
C. It undergoes oxidation when placed in $MgCl_2(aq)$.
D. It forms an acidic solution when placed in hot $H_2O(l)$.

12. Which of the following molecules is polar ?

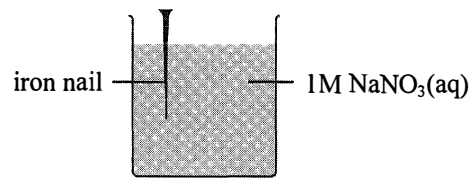
A. CO_2
B. PCl_3
C. SiF_4
D. SF_6

13. In which of the following cases would the iron nail corrode fastest ?

A.



B.



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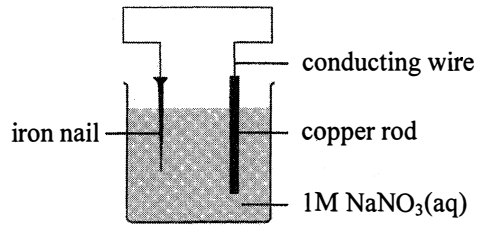

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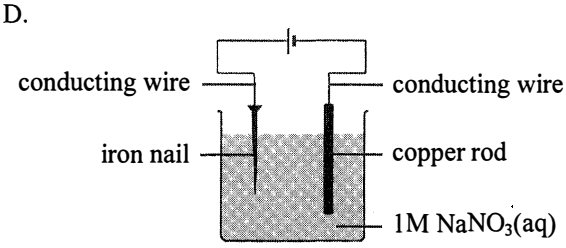


14. Which of the following statements concerning oxygen gas is correct ?

A. Oxygen gas relights a glowing splint.
B. Oxygen gas turns moist pH paper red.
C. Oxygen gas turns moist pH paper blue.
D. Oxygen gas gives a 'pop' sound when tested with a burning splint.

15. Consider the following chemical equation :

$3Ni(OH)_2(s) + xHCl(aq) + yAuCl_4^-(aq) \rightarrow 3NiCl_4(aq) + yAu(s) + zCl^-(aq) + 6H_2O(l)$

Which of the following combinations is correct ?

	x	y	z
A.	4	2	2
B.	6	2	2
C.	4	3	3
D.	6	3	3

16. Which of the following statements concerning helium is / are correct ?

(1) Helium is chemically inert.
(2) Helium exists as diatomic molecules.
(3) The outermost electron shell of a helium atom has an octet structure.

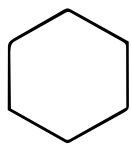
A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

17. Which of the following statements concerning NaOH(aq) and NH_3(aq) is / are correct ?

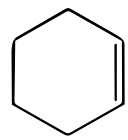
(1) Both of them can react with $MgCl_2$(aq).
(2) Both of them can form a deep blue solution with $Cu(OH)_2$(s).
(3) NaOH(aq) can react with CH_3COOH(aq), but NH_3(aq) cannot.

A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

18. The structures of organic compounds **A** and **B** are shown below :



A



B

Which of the following statements concerning the two compounds is / are correct ?

(1) **A** and **B** belong to the same homologous series.
(2) **A** and **B** can be distinguished by acidified $KMnO_4$(aq).
(3) Complete combustion of 1.0 g of **A** and complete combustion of 1.0 g of **B** would form the same mass of CO_2(g).

A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

19. Which of the following statements concerning anhydrous copper(II) sulphate powder are correct ?

(1) It is white in colour.
(2) It dissolves in water to give a blue solution.
(3) It can be obtained from heating hydrated copper(II) sulphate crystals.

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

20. Which of the following are characteristics exhibited by members of a homologous series ?

(1) They have similar chemical properties.
(2) They display a gradation in physical properties.
(3) They can be represented by the same general formula.

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

21. Which of the following can distinguish a sample of $AgNO_3(aq)$ from a sample of $NaNO_3(aq)$?

(1) adding $Cu(NO_3)_2(aq)$ to the samples
(2) adding HCl(aq) to the samples
(3) adding KOH(aq) to the samples

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

22. Which of the following statements concerning burning coal under room conditions are correct ?

(1) Burning coal forms both acidic and non-acidic substances.
(2) Burning coal forms both gaseous and non-gaseous substances.
(3) Burning coal forms both poisonous and non-poisonous substances.

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

23. What would be observed when a few drops of concentrated nitric acid is added to KI(aq) ?

(1) A brown solution is formed.
(2) A brown precipitate is formed.
(3) A reddish brown gas is released.

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

24. Consider the following statements and choose the best answer :

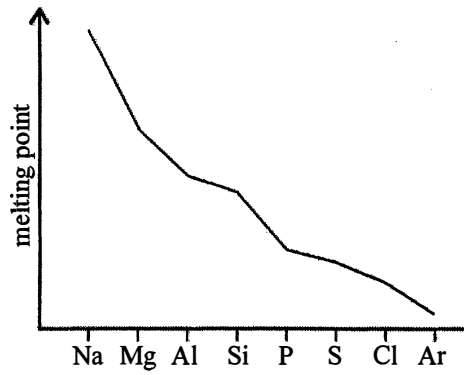
1st statement	**2nd statement**
Both buckminsterfullerene (C_{60}) and graphite are good conductors of electricity.	Buckminsterfullerene (C_{60}) and graphite are different forms of carbon.

A. Both statements are true and the 2nd statement is a correct explanation of the 1st statement.
B. Both statements are true but the 2nd statement is NOT a correct explanation of the 1st statement.
C. The 1st statement is false but the 2nd statement is true.
D. Both statements are false.

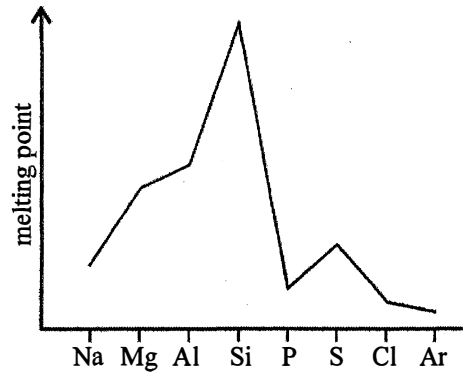
PART II

25. Which of the following graphs (not drawn to scale) shows the variation in melting points of the elements in the third period of the Periodic Table ?

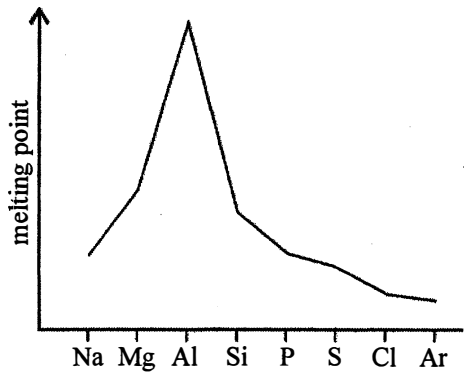
A.



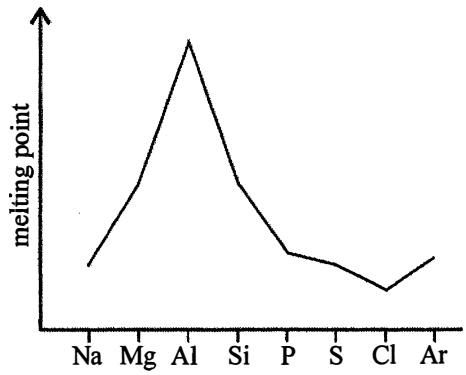
B.



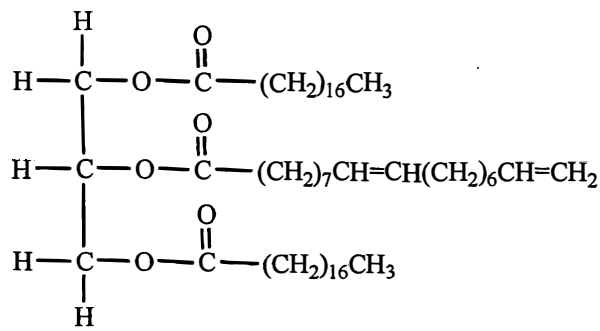
C.



D.



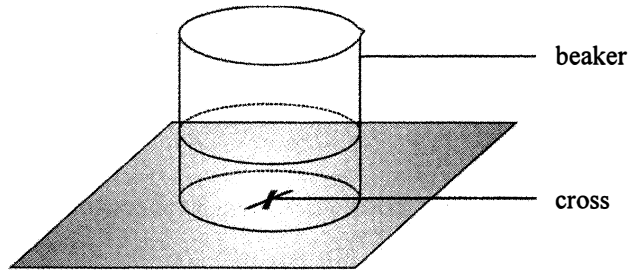
26. The structure of a compound is shown below :



How many *cis–trans* isomers does this compound have ?

A. 0
B. 2
C. 4
D. 8

Direction: Questions 27 and 28 refer to the following set-up.



27. **A**(aq) and **B**(aq) react to form a turbid mixture. Three trials of an experiment were performed to study the rate of the reaction. In each trial, **A**(aq) was mixed with $H_2O(l)$ in the beaker. After that, **B**(aq) was added to the mixture, and immediately started to measure the time needed for the cross to become invisible when viewed from above. The table below shows the relevant data.

Trial	Volume used / cm^3			Time / s
	A(aq)	$H_2O(l)$	**B**(aq)	
1	10.0	20.0	10.0	82
2	10.0	10.0	20.0	41
3	20.0	10.0	10.0	82

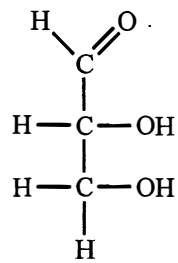
Which of the following statements concerning the rate of the reaction is correct ?

A. It depends on [**A**(aq)], and also depends on [**B**(aq)].
B. It increases with [**A**(aq)], but does not increase with [**B**(aq)].
C. It increases with [**B**(aq)], but does not increase with [**A**(aq)].
D. It does not depend on [**A**(aq)], and also does not depend on [**B**(aq)].

28. Of which of the following reactions can the rate be studied by the above set-up ?

A. $CaCl_2(aq) + H_2SO_4(aq) \rightarrow CaSO_4(s) + 2HCl(aq)$
B. $Na_2CO_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$
C. $2FeSO_4(aq) + 2H_2SO_4(l) \rightarrow Fe_2(SO_4)_3(aq) + 2H_2O(l) + SO_2(g)$
D. $Na_2S_2O_3(aq) + 2HCl(aq) \rightarrow S(s) + SO_2(aq) + H_2O(l) + 2NaCl(aq)$

29. A compound has the following structure :



Which of the following statements concerning the compound is correct ?

A. It can react with PCl_3.
B. It is insoluble in water.
C. It is optically inactive.
D. It has a ketone functional group.

30. Which of the following statements concerning silicon dioxide solid is correct ?

A. There are single covalent bonds between silicon atoms and oxygen atoms.
B. It is insoluble in sodium hydroxide solution.
C. It has a simple molecular structure.
D. It conducts electricity at room temperature.

Direction: Questions 31 and 32 refer to the following reaction involving four miscible liquids.

$$\mathbf{W}(l) + \mathbf{X}(l) \rightleftharpoons \mathbf{Y}(l) + \mathbf{Z}(l) \quad \Delta H = +45 \text{ kJ mol}^{-1}$$

At 25°C, the equilibrium constant K_c for the reaction is 2.5. In an experiment, 1.0 mol of **W**(l) and 1.0 mol of **X**(l) are placed in a closed container keeping at 25°C. When equilibrium is attained, the total volume of the reaction mixture is 0.20 dm^3.

31. How many moles of **Y**(l) would be present in the container when equilibrium is attained ?

A. 0.44
B. 0.61
C. 0.71
D. 0.83

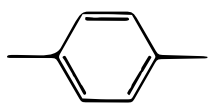
32. When equilibrium is attained, which of the following would increase the number of moles of **Y**(l) ?

(1) removing **Z**(l) from the reaction mixture
(2) increasing the volume of the container
(3) increasing the temperature of the reaction mixture

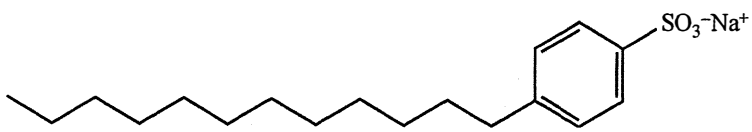
A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

33. The structures of three compounds are shown below :

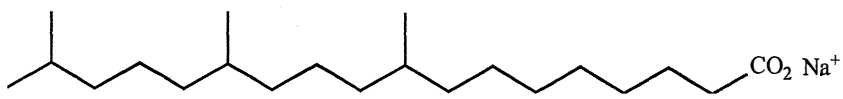
(1)



(2)



(3)



Which of them can form a stable emulsion when shaken with oil and water vigorously ?

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

34. Consider the following equilibrium system :

$$2CrO_4^{2-}(aq) + 2H^+(aq) \rightleftharpoons Cr_2O_7^{2-}(aq) + H_2O(l)$$

Which of the following statements are INCORRECT ?

(1) $[CrO_4^{2-}(aq)]$ must be equal to $[Cr_2O_7^{2-}(aq)]$.
(2) Both the forward reaction and the backward reaction have stopped.
(3) The number of moles of $CrO_4^{2-}(aq)$ must be double the number of moles of $Cr_2O_7^{2-}(aq)$.

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

35. Which of the following processes can form ethanol ?

(1) heating ethanoic acid with $NaBH_4$
(2) heating bromoethane with KOH(aq)
(3) heating ethyl butanoate with NaOH(aq) under reflux

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

36. Consider the following statements and choose the best answer :

1st statement	**2nd statement**
Both $CH_3(CH_2)_3OH$ and $(CH_3)_3COH$ can react with acidified $K_2Cr_2O_7(aq)$.	Both $CH_3(CH_2)_3OH$ and $(CH_3)_3COH$ have the same functional group.

A. Both statements are true and the 2nd statement is a correct explanation of the 1st statement.
B. Both statements are true but the 2nd statement is NOT a correct explanation of the 1st statemer
C. The 1st statement is false but the 2nd statement is true.
D. Both statements are false.

END OF SECTION A

2017-DSE
CHEM
PAPER 1B

B

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HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2017

Candidate Number									

CHEMISTRY PAPER 1

SECTION B : Question-Answer Book B

This paper must be answered in English

INSTRUCTIONS FOR SECTION B

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3, 5, 7 and 9.

(2) Refer to the general instructions on the cover of the Question Paper for Section A.

(3) This section consists of TWO parts, Parts I and II.

(4) Answer ALL questions in both Parts I and II. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.

(5) An asterisk (*) has been put next to the questions where one mark will be awarded for effective communication.

(6) Supplementary answer sheets will be provided on request. Write your candidate number, mark the question number box and stick a barcode label on each sheet, and fasten them with string INSIDE this Question-Answer Book.

(7) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

* A 1 4 0 E 0 1 B *

PART I

Answer **ALL** questions. Write your answers in the spaces provided.

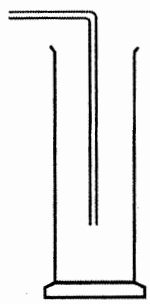
1. Barium (Ba) is an element in Group II of the Periodic Table. Its chemical properties are similar to those of calcium.

(a) Describe the bonding in barium.

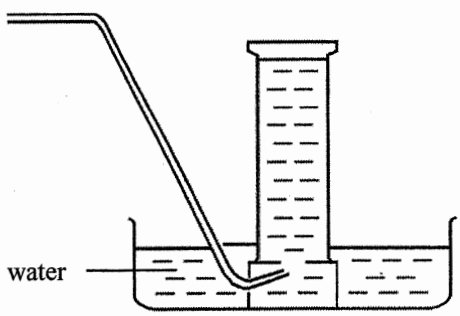
(2 marks)

(b) A gas with a pungent smell is formed when $Ba(OH)_2(s)$ is heated with $NH_4Cl(s)$. State the reason why the gas CANNOT be collected by each of the following methods.

(i) Reason :



(ii) Reason :



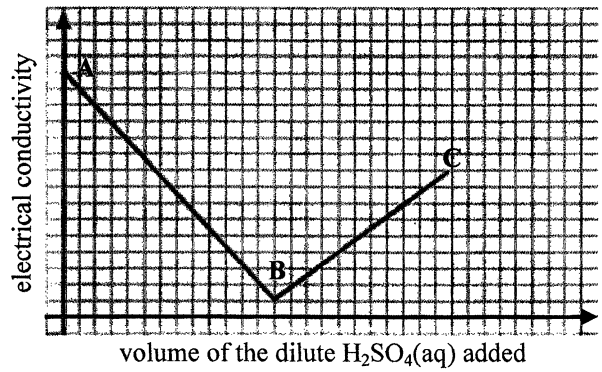
(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Please stick the barcode label here.

1. (c) An experiment was carried out to study the change in electrical conductivity of the mixture formed when a dilute $H_2SO_4(aq)$ was added gradually to a fixed volume of a dilute $Ba(OH)_2(aq)$. The graph below shows the results of the experiment.



(i) State the expected observation when dilute $H_2SO_4(aq)$ is added to dilute $Ba(OH)_2(aq)$.

(ii) Explain the change of electrical conductivity in the following stages :

(1) From **A** to **B**

(2) From **B** to **C**

(3 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

2. Water pipes used to carry drinking water are commonly made of copper instead of iron. Although lead-containing solder can be used to join these water pipes, such use is prohibited.

(a) Suggest one chemical property of copper that makes it more suitable than iron for making water pipes. Explain your answer.

(2 marks)

(b) (i) Suggest one reason of adding lead to soldering materials.

(ii) Explain why lead-containing solder is prohibited in joining these water pipes.

(2 marks)

(c) A city stipulates that the concentration of lead ions in drinking water should not exceed 1.0×10^{-8} g cm^{-3}. Express this concentration in mol dm^{-3}.
(Relative atomic mass : Pb = 207.2)

(2 marks)

Answers written in the margins will not be marked.

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Please stick the barcode label here.

3. Answer the following questions.

(a) Explain why propene can form a polymer, but propane cannot.

(1 mark)

(b) Explain why $HO_2C(CH_2)_4CO_2H$ can form a polymer with $H_2N(CH_2)_6NH_2$, but $CH_3(CH_2)_4CO_2H$ cannot.

(2 marks)

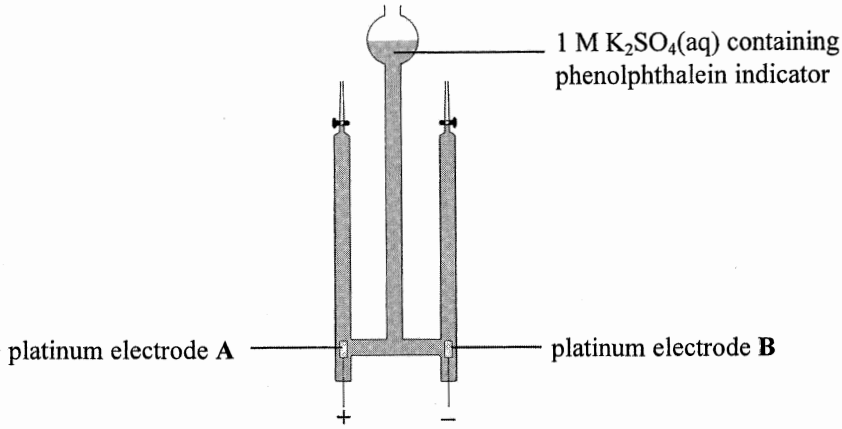
(c) Describe the formation of dative covalent bond using H_3O^+ as example.

(3 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

4. The diagram below shows a set-up for the electrolysis of a colourless solution of 1 M K_2SO_4(aq) containing phenolphthalein indicator.



(a) State, with explanation, the expected observation around the following electrodes during the electrolysis :

(i) electrode **A**

(ii) electrode **B**

(3 marks)

(b) Write the equation of the overall reaction in the electrolysis.

(1 mark)

(c) Explain whether there are any changes in the expected observation around the following electrodes during the electrolysis if the 1 M K_2SO_4(aq) is replaced with 1 M H_2SO_4(aq) :

(i) electrode **A**

(ii) electrode **B**

(3 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Please stick the barcode label here.

5. Explain the following increasing order of the boiling points of three substances :

$H_2 < F_2 < HF$

(3 marks)

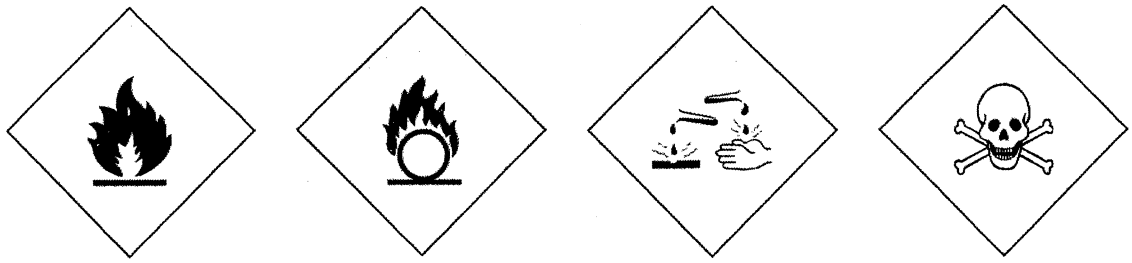
Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

6. Concentrated sulphuric acid is a reagent commonly found in laboratories.

(a) Circle TWO hazard warning labels that should be displayed on a bottle of concentrated sulphuric acid :



(1 mark)

(b) In order to determine the concentration of a sample of concentrated sulphuric acid, 5.00 cm^3 of the sample was diluted to 1000.0 cm^3 with deionised water. Portions of 25.00 cm^3 of the diluted sample were titrated with 0.189 mol dm^{-3} NaOH(aq) using methyl orange as an indicator. An average of 22.20 cm^3 of NaOH(aq) was used to reach the end point.

(i) Explain why concentrated sulphuric acid should NOT be titrated directly with NaOH(aq).

(ii) State the colour change at the end point of the titration.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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Answers written in the margins will not be marked.

6. (b) (iii) Calculate the concentration of the sample of concentrated sulphuric acid, in mol dm^{-3}.

(5 marks)

(c) With the help of a chemical equation, state the observation when hot concentrated sulphuric acid reacts with copper.

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

7. Ethyne is a gaseous hydrocarbon with molecular formula C_2H_2.

(a) Suggest why the enthalpy change of formation of $C_2H_2(g)$ CANNOT be determined directly by experiment.

(1 mark)

(b) Hess's law can be used to find enthalpy changes which CANNOT be determined directly by experiment. State Hess's law.

(1 mark)

(c) Based on the enthalpy changes of combustion ΔH_c of $C_2H_2(g)$, C(graphite) and $H_2(g)$ to construct an enthalpy change cycle and applying Hess's law can give the enthalpy change of formation of $C_2H_2(g)$.

(i) Draw, with labels, this enthalpy change cycle.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

7. (c) (ii) The standard enthalpy changes of combustion $\Delta H_c^{\ominus}$ of $C_2H_2(g)$, C(graphite) and $H_2(g)$ are given below :

	$\Delta H_c^{\ominus}$ / kJ mol^{-1}
$C_2H_2(g)$	–1300
C(graphite)	–394
$H_2(g)$	–286

(1) State the standard conditions for 'standard enthalpy change'.

(2) Calculate the standard enthalpy change of formation of $C_2H_2(g)$.

(5 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

8. Combustion of petrol increases the concentration of carbon dioxide in the atmosphere, and may contribute to global warming. Combustion of petrol also emits poisonous air pollutants.

(a) Write a chemical equation for the complete combustion of octane (C_8H_{18}), a component in petrol.

(1 mark)

(b) Draw the electron diagram for a molecule of carbon dioxide, showing *electrons in the outermost shells* only.

(1 mark)

(c) Give one reason FOR and one reason AGAINST the following statement :

'Switching from using petrol-driven cars to using electric cars can help alleviate global warming.'

FOR :
AGAINST :

(2 marks)

(d) Carbon monoxide is one of the poisonous air pollutants emitted from the combustion of petrol. Under what condition would carbon monoxide be formed during the combustion of petrol ?

(1 mark)

(e) (i) Name a device that can be installed in petrol-driven cars so as to reduce the emission of carbon monoxide.

(ii) Suggest one air pollutant in car exhaust which cannot be removed by the device in (i).

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

*9. Four unlabelled reagent bottles each contains one of the colourless liquids listed below :

$HOCH_2CH_2CH_2OH$ $CH_3CO_2CH_3$ $CH_3CH_2CO_2H$ $CH_2=CHCO_2H$

Suggest chemical tests to distinguish the four liquids.

(5 marks)

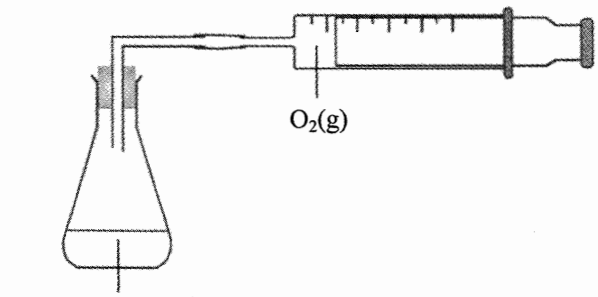
Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

PART II

Answer **ALL** questions. Write your answers in the spaces provided.

10. In an experiment performed under room conditions as shown below, 5.00 cm^3 of $H_2O_2(aq)$ decomposed into $O_2(g)$ and $H_2O(l)$ in the presence of a catalyst. $O_2(g)$ was continuously released from the start of the experiment until the third minute when a total of 60 cm^3 of gas was collected. After that, no more gas was collected.



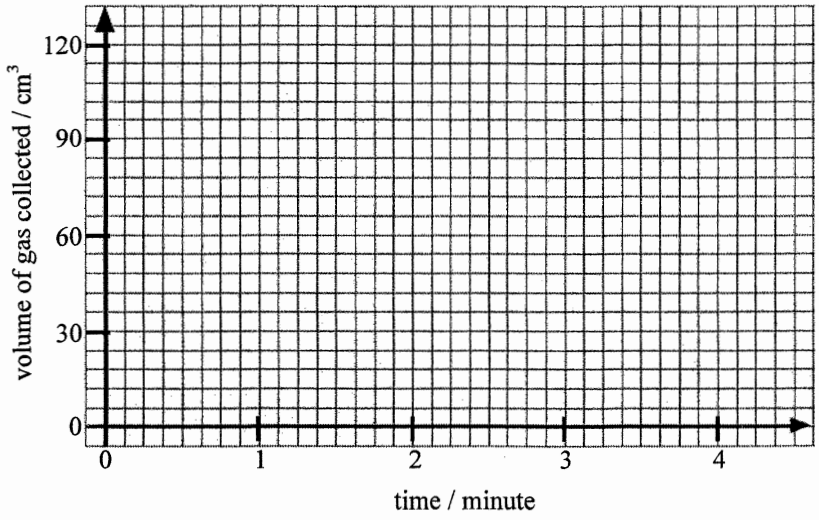
(a) Calculate the initial concentration of the $H_2O_2(aq)$, in mol dm^{-3}.
(Molar volume of gas at room conditions = 24 dm^3)

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

10. (b) In the graph below, sketch the variation of the volume of gas collected with time in the first 4 minutes.



(2 marks)

(c) The experiment is repeated using a $H_2O_2(aq)$ at a higher temperature but other conditions remain unchanged. Explain whether the total volume of gas obtained would still be 60 cm^3. (The volume of gas is measured at room conditions.)

(1 mark)

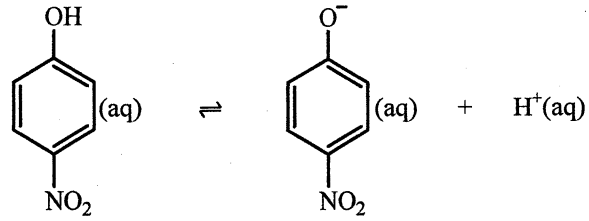
(d) Suggest another method that can be used to follow the progress of this reaction.

(1 mark)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

11. The equation below shows the ionisation of 4-nitrophenol in water :



4-nitrophenol (colourless) ⇌ 4-nitrophenoxide ion (yellow)

At 25°C, the equilibrium constant K_c for the ionisation is 8.0×10^{-8} mol dm^{-3}.

(a) Write an expression for K_c.
(You may use **HA** to represent 4-nitrophenol and $\mathbf{A}^-$ to represent 4-nitrophenoxide ion.)

(1 mark)

(b) When the above ionisation attains equilibrium at 25°C, the pH of an aqueous solution of 4-nitrophenol is 2.4. Calculate the ratio of the concentration of 4-nitrophenol to the concentration of 4-nitrophenoxide ions in this solution.

(2 marks)

(c) Suggest if there is any colour change when NaOH(aq) is added gradually into the solution in (b). Explain your answer.

(2 marks)

(d) Suggest one possible use of 4-nitrophenol in acid-base titration experiments.

(1 mark)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

12. Consider the following conversions :

$$\underset{\textbf{A}}{C_5H_{10}O} \longrightarrow \underset{\textbf{B}}{C_5H_{12}O} \xrightarrow{HBr} \underset{\textbf{C}}{\text{3-bromopentane}}$$

optically active — optically inactive

(a) Write the structural formula of **C**.

(1 mark)

(b) (i) Deduce the structural formula of **B**.

(ii) Name the type of reaction for the conversion of **B** to **C**.

(3 marks)

(c) (i) Deduce the structural formula of **A**. Label on this structural formula all chiral centre(s), if any, by using '$*$'.

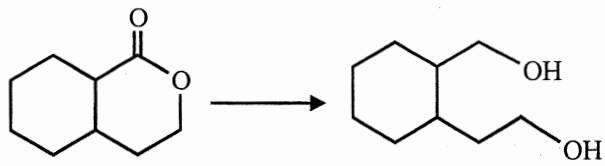
(ii) State the reagent(s) required for the conversion of **A** to **B**.

(3 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

13. Outline a synthetic route, with *no more than three steps*, to accomplish the following conversion. For each step, give the reagent(s), reaction conditions (as appropriate) and the structure of the organic product.



(3 marks)

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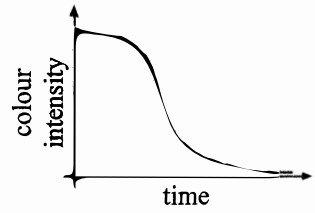
*14. At 60°C, $MnO_4^-(aq)$ reacts with $C_2O_4^{2-}(aq)$ in an acidic medium to give $Mn^{2+}(aq)$, $CO_2(g)$ and $H_2O(l)$. The graph below shows the variation of the colour intensity of the reaction mixture with time.



Based on the information above, **write the chemical equation** for the reaction and illustrate THREE characteristics of transition metals exhibited by manganese.

(6 marks)

END OF SECTION B
END OF PAPER

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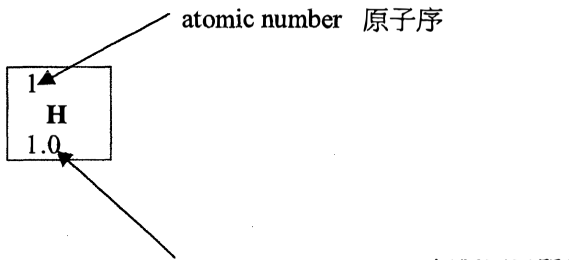
PERIODIC TABLE 周期表

GROUP 族



I	II											III	IV	V	VI	VII	0
																	2 **He** 4.0
3 **Li** 6.9	4 **Be** 9.0											5 **B** 10.8	6 **C** 12.0	7 **N** 14.0	8 **O** 16.0	9 **F** 19.0	10 **Ne** 20.2
11 **Na** 23.0	12 **Mg** 24.3											13 **Al** 27 0	14 **Si** 28.1	15 **P** 31.0	16 **S** 32.1	17 **Cl** 35.5	18 **Ar** 40.0
19 **K** 39.1	20 **Ca** 40.1	21 **Sc** 45.0	22 **Ti** 47.9	23 **V** 50.9	24 **Cr** 52.0	25 **Mn** 54.9	26 **Fe** 55.8	27 **Co** 58.9	28 **Ni** 58.7	29 **Cu** 63.5	30 **Zn** 65.4	31 **Ga** 69.7	32 **Ge** 72.6	33 **As** 74.9	34 **Se** 79.0	35 **Br** 79.9	36 **Kr** 83.8
37 **Rb** 85.5	38 **Sr** 87.6	39 **Y** 88.9	40 **Zr** 91.2	41 **Nb** 92.9	42 **Mo** 95.9	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
55 **Cs** 132.9	56 **Ba** 137.3	57 * **La** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.9	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89 ** **Ac** (227)	104 **Rf** (261)	105 **Db** (262)													

*	58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0
**	90 **Th** 232.0	91 **Pa** (231)	92 **U** 238.0	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (260)