HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2018

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. Which of the following processes is most suitable for extracting sodium chloride from sea water ?

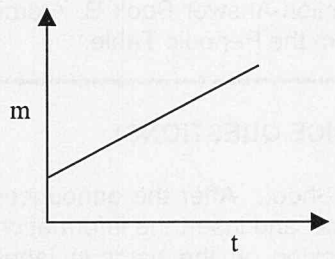
   A. electrolysis
   B. crystallisation
   C. simple distillation
   D. fractional distillation

2. Neon exists as a gas at room temperature and pressure because

   A. neon is chemically inert.
   B. neon molecules are monoatomic.
   C. the attractive force between neon atoms is weak.
   D. the outermost electron shell of a neon atom has an octet structure.

3. A certain mass of a sample of $Ag_2O(s)$ is strongly heated in a test tube. Which of the following shows the relationship of the mass of the contents (m) in the test tube with time (t) from the start of heating ?

A.



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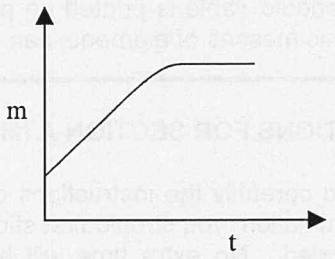

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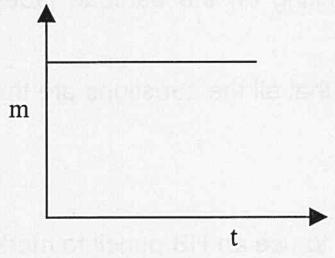

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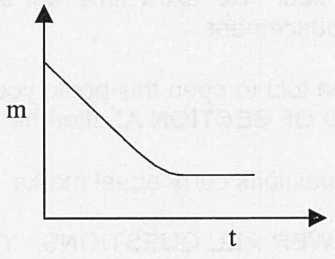

4. If 8.0 g of sulphur dioxide gas contains **n** molecules, how many molecules does 2.0 g of oxygen gas contain ?

   (Relative atomic masses : O = 16.0, S = 32.0)

   A. 2.0 **n**
   B. 4.0 **n**
   C. 0.25 **n**
   D. 0.50 **n**

5. Quartz (SiO_2) is harder than dry ice (CO_2) because

A. the atomic size of silicon is larger than that of carbon.
B. a silicon atom has more electrons than a carbon atom has.
C. quartz has a giant network structure, but dry ice consists of discrete molecules.
D. the silicon–oxygen bond in quartz is strong, but the carbon–oxygen bond in dry ice is weak.

6. Dilute sodium hydroxide solution is added to a 0.1 M solution until in excess. Which of the following combinations is correct ?

	Solution	Observation
A.	zinc sulphate	white precipitate formed
B.	calcium nitrate	white precipitate formed
C.	lead(II) nitrate	yellow precipitate formed
D.	iron(III) sulphate	dirty green precipitate formed

7. Which of the following statements concerning iron and magnesium is correct ?

A. Iron is ductile but magnesium is not.
B. Iron corrodes less readily than magnesium.
C. The abundance of magnesium is higher than that of iron in the earth crust.
D. Both magnesium and iron can have more than one oxidation number in their oxides.

8. Which of the following molecular formulae can represent an alkanoic acid ?

A. CH_2O
B. $C_2H_6O_2$
C. $C_4H_8O_2$
D. $C_4H_{10}O_2$

9. **X**, **Y** and **Z** are different metals. When they are placed separately in NaCl(aq), only **Y** gives colourless gas bubbles. When each of their oxides is heated strongly, only the oxide of **X** gives a colourless gas. Which of the following shows the decreasing order of reactivity of these three metals ?

A. **Y** > **Z** > **X**
B. **X** > **Y** > **Z**
C. **Y** > **X** > **Z**
D. **Z** > **Y** > **X**

10. Which of the following reagents does NOT react with copper ?

A. 2 M H_2SO_4
B. 2 M HNO_3
C. 16 M H_2SO_4
D. 16 M HNO_3

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11. Consider the solutions **W**, **X**, **Y** and **Z** below :

W	100 cm^3 of 0.20 M $HNO_3(aq)$
X	50 cm^3 of 0.20 M $HCl(aq)$
Y	100 cm^3 of 0.20 M $CH_3CO_2H(aq)$
Z	50 cm^3 of 0.10 M $NaOH(aq)$

Which of the following statements is correct ?

A. The pH of **Y** equals –log 0.2.
B. Mixing **W** and **Z** gives a neutral solution.
C. The pH of the mixture of **W** and **X** is lower than that of **W**.
D. The pH of the mixture of **W** and **X** is lower than that of the mixture of **X** and **Y**.

12. Which of the following is NOT a redox reaction ?

A. $2Mg + SO_2 \rightarrow 2MgO + S$
B. $CaCO_3 + SiO_2 \rightarrow CaSiO_3 + CO_2$
C. $Cu_2O + H_2SO_4 \rightarrow CuSO_4 + Cu + H_2O$
D. $3CuS + 8HNO_3 \rightarrow 3CuSO_4 + 8NO + 4H_2O$

13. The reaction below involves several steps.

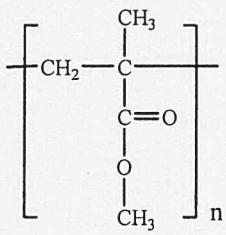
$$CH_4(g) + Cl_2(g) \xrightarrow{\text{sunlight}} CH_3Cl(g) + HCl(g)$$

Which of the following steps can lead to a termination of the reaction ?

Note :

A. $Cl_2 \rightarrow 2Cl\bullet$
B. $CH_3\bullet + Cl\bullet \rightarrow CH_3Cl$
C. $CH_4 + Cl\bullet \rightarrow CH_3\bullet + HCl$
D. $CH_3\bullet + Cl_2 \rightarrow CH_3Cl + Cl\bullet$

14. A polymer has the following structure :



Which of the following statements concerning the polymer is correct ?

A. It is a polyester.
B. It can be polymerised from $(CH_3)_2CHCO_2CH_3$.
C. Its monomer can decolourise acidified $KMnO_4(aq)$.
D. It can be made from its monomer through condensation.

15. The diagram below shows an apparatus :

Which of the following mixtures can be separated by this apparatus ?

A. rock salt and sand
B. propan-2-ol and water
C. hexane (C_6H_{14}) and water
D. methanoic acid and ethanoic acid

16. Which of the following molecules is / are non-polar ?

(1) BCl_3
(2) PCl_3
(3) $CHCl_3$

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

17. Which of the following statements is / are correct ?

(1) The density of $H_2O(l)$ is lower than that of $H_2O(g)$.
(2) When ice changes to water, the open structure of ice collapses.
(3) When the temperature of water rises from 10 °C to 30 °C, the average distance between H_2O molecules increases.

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

Go on to the next page

18. Consider the following information :

$$2H_2O(l) \rightarrow 2H_2(g) + O_2(g) \qquad \Delta H^\ominus = +\mathbf{x}\ kJ\ mol^{-1}$$

Which of the following statements is / are correct ?

(1) The standard enthalpy change of formation of $H_2O(l)$ is $-0.5\mathbf{x}$ kJ mol^{-1}.
(2) The standard enthalpy change of formation of $H_2O(l)$ is $+0.5\mathbf{x}$ kJ mol^{-1}.
(3) The standard enthalpy change of combustion of $H_2(g)$ is $-\mathbf{x}$ kJ mol^{-1}.

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

19. In an experiment, marble is heated in a boiling tube and the gas evolved is passed into a test tube with limewater. Which of the following statements concerning the experiment is / are correct ?

(1) The marble turns brick red upon heating.
(2) The limewater turns milky initially but eventually becomes a colourless solution.
(3) If marble is replaced by chalk, a similar observation would be obtained.

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

20. Which of the following hazard warning labels should be displayed on a bottle containing propan-2-ol ?


(1)


(2)


(3)

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

21. Which of the following statements concerning a zinc-carbon cell is / are INCORRECT ?

(1) The graphite rod is inserted in a mixture of graphite powder and MnO_2.
(2) Potassium hydroxide acts as an electrolyte.
(3) Ammonia forms around the cathode.

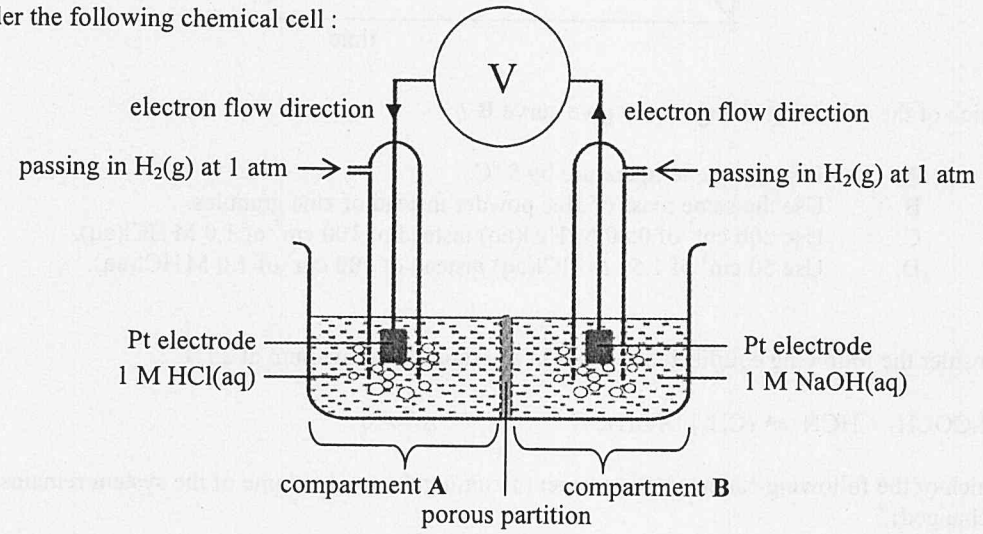
A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

22. Which of the following processes are endothermic ?

(1) melting of wax
(2) cracking of heavy oil
(3) adding zinc powder to $CuSO_4(aq)$

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

23. Consider the following chemical cell :



Which of the following statements are correct ?

(1) The pH of the solution in compartment **A** decreases gradually.
(2) Hydrogen gas in compartment **B** acts as a reducing agent.
(3) The equation for the overall reaction is : $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

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**
To completely neutralise 1 mole of HCl(aq), the number of moles of $NH_3(aq)$ needed is more than the number of moles of KOH(aq) needed.	$NH_3(aq)$ is a weaker alkali than KOH(aq).

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.

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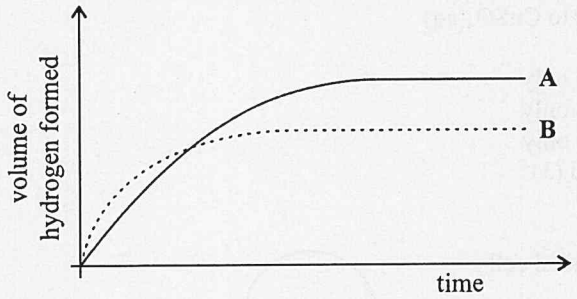
PART II

25. 100 cm^3 of 1.0 M HCl(aq) reacts with excess zinc granules giving curve **A** in the graph below.



Which of the following changes may give curve **B** ?

A. Increase the temperature by 5 °C.
B. Use the same mass of zinc powder instead of zinc granules.
C. Use 200 cm^3 of 0.80 M HCl(aq) instead of 100 cm^3 of 1.0 M HCl(aq).
D. Use 50 cm^3 of 1.50 M HCl(aq) instead of 100 cm^3 of 1.0 M HCl(aq).

26. Consider the following equilibrium system in a certain liquid medium at 25 °C :

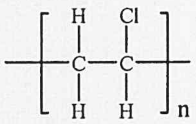
$CH_3COCH_3 + HCN \rightleftharpoons (CH_3)_2C(OH)CN \qquad \Delta H > 0$

Which of the following statements is correct (assuming the total volume of the system remains unchanged) ?

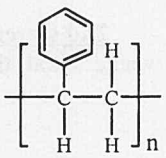
A. Adding $(CH_3)_2C(OH)CN$ would increase the equilibrium constant K_c.
B. Increasing the temperature would increase the concentration of $(CH_3)_2C(OH)CN$.
C. The concentration of CH_3COCH_3 must be equal to the concentration of $(CH_3)_2C(OH)CN$.
D. After adding HCN and when a new equilibrium is attained, the concentration of HCN would be restored to the value before the addition of HCN.

27. Which of the following polymers is commonly used to make drainage pipes ?

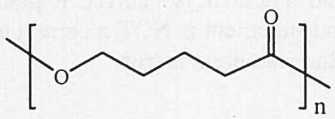
A.



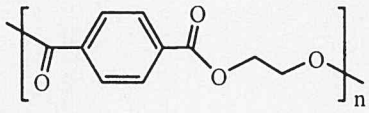
B.



C.



D.



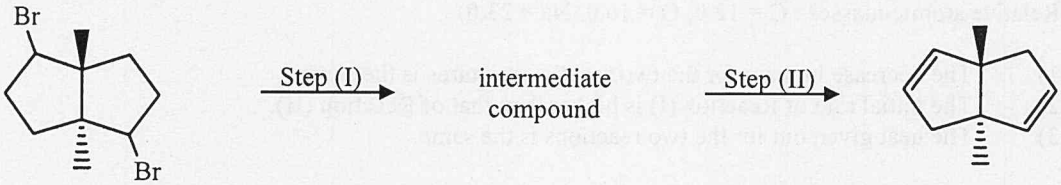
28. Which of the following statements is correct ?

A. The boiling point of argon is lower than that of neon.
B. The boiling point of nitrogen is lower than that of oxygen.
C. The melting point of silicon is lower than that of sodium.
D. The melting point of aluminium is lower than that of magnesium.

29. The equilibrium constant K_c for the reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ at 70 °C is 0.13 mol dm^{-3}. In a 5.0 dm^3 closed container kept at 70 °C, there is a mixture of 0.20 mol of $N_2O_4(g)$ and 0.30 mol of $NO_2(g)$ at a certain moment. Which of the following combinations is correct at that moment ?

	Reaction quotient Q_c / mol dm^{-3}	**Rate of the reaction**
A.	0.09	backward > forward
B.	0.09	forward > backward
C.	0.45	backward > forward
D.	0.45	forward > backward

30. Consider the following conversion :



Which of the following combinations can achieve the above conversion ?

	Reagent used in Step (I)	Reagent used in Step (II)
A.	aqueous ammonia	dilute sulphuric acid
B.	aqueous potassium hydroxide	dilute sulphuric acid
C.	aqueous ammonia	concentrated sulphuric acid
D.	aqueous potassium hydroxide	concentrated sulphuric acid

31. Which of the following compounds CANNOT form condensation polymers ?

(1) $H_2N(CH_2)_5CO_2H$
(2) $CH_3CO_2CH{=}CH_2$
(3) $CH_3CH(OH)CO_2H$

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

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32. Which of the following processes can illustrate the characteristics of transition metals ?

(1) mixing $AgNO_3(aq)$ and $NaCl(aq)$
(2) mixing $FeSO_4(aq)$ and $Br_2(aq)$
(3) mixing $CuSO_4(s)$ and $H_2O(l)$

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

33. Consider the following two reactions :

Reaction	Reactants		
(I)	1.0 g of $Na_2CO_3(s)$	+	100.0 cm^3 of 1.0 M $HCl(aq)$
(II)	1.0 g of $Na_2CO_3(s)$	+	100.0 cm^3 of 1.0 M $CH_3COOH(aq)$

Which of the following statements are correct if the two reactions are performed under the same experimental conditions ?

(Relative atomic masses : C = 12.0, O = 16.0, Na = 23.0)

(1) The decrease in mass for the two reaction mixtures is the same.
(2) The initial rate of Reaction (I) is higher than that of Reaction (II).
(3) The heat given out for the two reactions is the same.

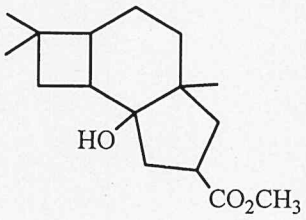
A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

34. Which of the following statements concerning soap are correct ?

(1) Soap is an ester.
(2) Soap can reduce the surface tension of water.
(3) Soap particles consist of both hydrophobic and hydrophilic parts.

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

35. An organic compound has the following structure :



Which of the following statements concerning this compound are correct ?

(1) It has an ester group.
(2) It contains at least one chiral centre.
(3) It reacts with acidified sodium dichromate solution to form a ketone.

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**
The molar volume of bromine is larger than that of fluorine at room temperature and pressure.	The molecular size of bromine is larger than that of fluorine.

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.

END OF SECTION A