2014-DSE
CHEM
PAPER 1A

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2014

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

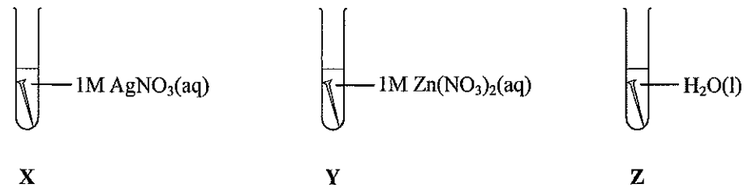
1. Which of the following atoms has the smallest number of neutrons ?

   A. ^{63}Cu
   B. ^{59}Co
   C. ^{58}Ni
   D. ^{57}Fe

2. Which of the following compounds has a giant ionic structure ?

   A. N_2O_4
   B. HNO_3
   C. NCl_3
   D. NH_4NO_3

3. The diagram below shows three iron nails of the same size and shape each immersed in a liquid.



   Which of the following arrangements represents the ascending order of rate of corrosion of the iron nails ?

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

4. Refer to the following chemical equation :

   $Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(s) + 3CO_2(g)$

   N moles of Fe_2O_3 are allowed to react with **2 N** moles of CO under suitable conditions until the reaction stops. How many moles of Fe are formed ?

   A. **N**
   B. **2 N**
   C. $\frac{2}{3}$**N**
   D. $\frac{4}{3}$**N**

5. Hydrated salt $\mathbf{X} \cdot n H_2O$ contains 51.16% of water by mass. Given that the molar mass of **X** is 120.3 g, what is **n** ?

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

   A. 2
   B. 5
   C. 7
   D. 10

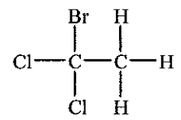
6. 50.0 cm^3 of 0.6 M $FeSO_4(aq)$ is mixed with 150.0 cm^3 of 0.2 M $Fe_2(SO_4)_3(aq)$. What is the concentration of $SO_4^{2-}(aq)$ ions in the resulting mixture ?

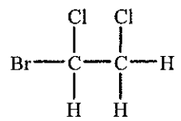
   A. 0.3 M
   B. 0.4 M
   C. 0.6 M
   D. 0.8 M

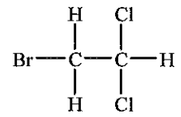
7. Which of the following pairs of aqueous solutions, upon mixing, would have the lowest electrical conductivity ?

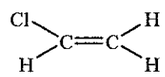
   A. 20.0 cm^3 of 0.1 M HNO_3 and 20.0 cm^3 of 0.1 M KOH
   B. 20.0 cm^3 of 0.1 M H_2SO_4 and 20.0 cm^3 of 0.1 M $Ba(OH)_2$
   C. 20.0 cm^3 of 0.1 M CH_3COOH and 20.0 cm^3 of 0.1 M NH_3
   D. 20.0 cm^3 of 0.1 M HCl and 20.0 cm^3 of 0.1 M $C_6H_{12}O_6$(glucose)

8. Which of the following compounds would be formed when bromoethene reacts with chlorine in a suitable organic solvent ?

   A.


   B.


   C.


   D.


9. The enthalpy changes of three reactions under certain conditions are shown below :

Reaction	Enthalpy change
$B_2H_6(g) + 3O_2(g) \rightarrow B_2O_3(s) + 3H_2O(l)$	-2170 kJ mol^{-1}
$B(s) + \frac{3}{4}O_2(g) \rightarrow \frac{1}{2}B_2O_3(s)$	-635 kJ mol^{-1}
$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$	-286 kJ mol^{-1}

   Which of the following is the enthalpy change of formation of $B_2H_6(g)$ under the same conditions ?

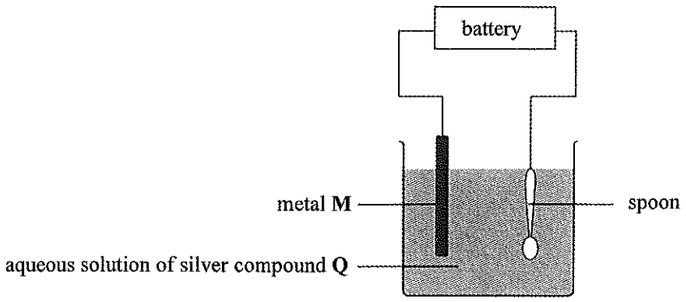
   A. +42 kJ mol^{-1}
   B. +614 kJ mol^{-1}
   C. +677 kJ mol^{-1}
   D. +1249 kJ mol^{-1}

Go on to the next page

10. One mole of methane is allowed to react with two moles of chlorine in the presence of light. Which of the following best describes the organic product(s) that would be formed ?

A. one mole of CCl_4
B. one mole of CH_2Cl_2
C. a mixture containing only CCl_4 and CH_2Cl_2
D. a mixture containing CH_3Cl, CH_2Cl_2, $CHCl_3$ and CCl_4

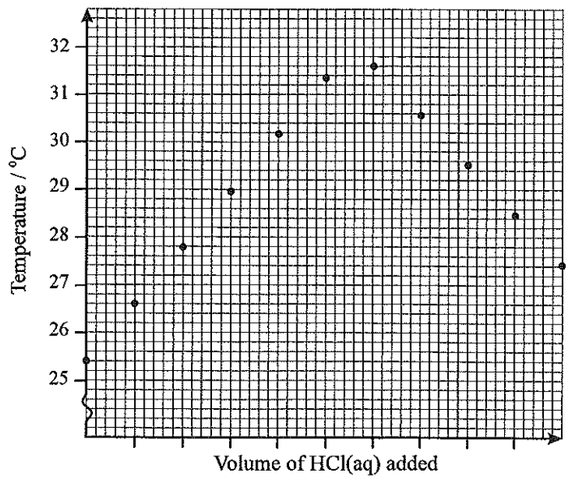
11. The diagram below shows a set-up in which silver is being plated on a spoon :



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

A. **M** must be silver.
B. **Q** can be silver chloride.
C. The spoon is connected to the negative pole of the battery.
D. Electrons flow from metal **M** to the spoon through the solution.

12. In an experiment, standard HCl(aq) was added from a burette to a known volume of NaOH(aq) placed in an expanded polystyrene cup. The graph below shows the temperatures of the mixture in the cup during the process :



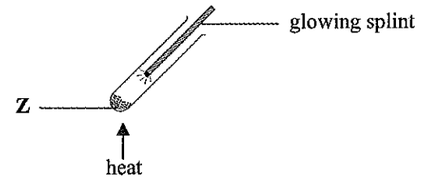
What is the greatest temperature rise of the mixture in the cup as estimated from the graph above ?

A. 2.0 °C
B. 4.6 °C
C. 6.2 °C
D. 6.6 °C

13. Which of the following gases, after dissolved in 1 dm^3 of water, would give a solution with the highest pH ?

A. 0.002 mol of NO_2
B. 0.002 mol of SO_2
C. 0.002 mol of NH_3
D. 0.002 mol of HCl

14. As shown in the diagram below, the glowing splint relights when solid **Z** is heated.



Which of the following chemicals may **Z** be ?

A. HgO
B. Al_2O_3
C. $CaCO_3$
D. $MgCO_3$

15. Which of the following hazard warning labels should be displayed on both the reagent bottle storing concentrated sulphuric acid and the reagent bottle storing concentrated hydrochloric acid ?

(1) 

(2) 

(3) 

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

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

(1) The zinc case would become thinner when being used.
(2) Its voltage remains unchanged when being used.
(3) It can be recharged after use.

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

17. What are the advantages of using natural gas over using coal as a fuel in power stations ?

(1) In comparing with coal, natural gas burns more completely.
(2) In comparing with coal, natural gas has less sulphur-containing substances.
(3) Natural gas is a renewable energy source, but coal is not.

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

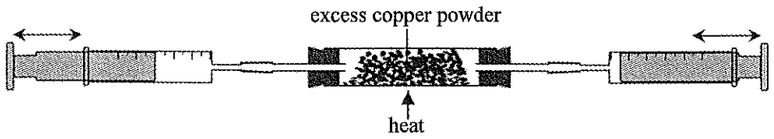
Go on to the next page

18. In an experiment, a small piece of potassium is added to a trough of water containing phenolphthalein. Which of the following statements concerning the experiment are correct ?

(1) An exothermic reaction occurs.
(2) A colourless solution is formed.
(3) The metal burns with a lilac flame.

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

19. The set-up of an experiment is shown below. At room temperature, the system initially contains 40 cm^3 of $N_2(g)$, 25 cm^3 of $O_2(g)$ and 10 cm^3 of He(g).

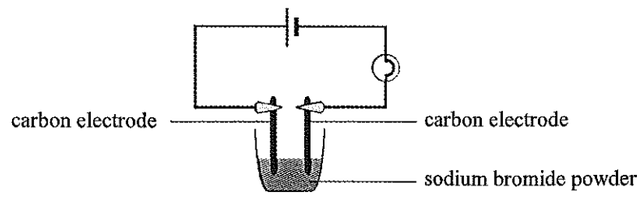


The plungers of the gas syringes are moved to and fro until there is no further change in the system. The system is then allowed to cool to room temperature. Which of the following statements concerning the experiment are correct ?

(1) Some copper powder would change to a black substance.
(2) The total volume of the gases in the system would decrease by 25 cm^3.
(3) The same change in total volume of the gases would be observed if excess copper powder is replaced with excess iron powder.

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

20. The diagram below shows the set-up of an experiment :



Which of the following methods may light up the light bulb ?

(1) heating the sodium bromide powder until molten
(2) adding deionised water to the sodium bromide powder
(3) replacing the sodium bromide powder with bromine liquid

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 processes would show a blue colour ?

(1) adding litmus to NaOH(aq)
(2) mixing $CuSO_4(s)$ and $NH_3(aq)$
(3) mixing $K_3Fe(CN)_6(aq)$ and $FeCl_2(aq)$

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 molecules have non-octet structures ?

(1) NO_2
(2) PBr_3
(3) BCl_3

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

23. When a negatively charged rod is placed near a jet of liquid running out from a burette, the jet of liquid deflects towards the rod. Which of the following may the liquid be ?

(1) water
(2) hexane
(3) trichloromethane

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

Directions : Question 24 consists of two separate statements. Decide whether each of the two statements is true or false; if both are true, then decide whether or not the second statement is a *correct* explanation of the first statement. Then select one option from A to D according to the following table :

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.

	1st statement	**2nd statement**
24.	All acidic gases can react with CaO(s) to form salt and water only.	All acidic gases contain hydrogen as one of their constituent atoms.

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PART II

25. $H_2O_2(aq)$ decomposes into $H_2O(l)$ and $O_2(g)$ in the presence of $MnO_2(s)$. Two experiments are performed to study this decomposition under the same conditions, except that 50 cm^3 of 2M $H_2O_2(aq)$ is used in Experiment (1), while 100 cm^3 of 1M $H_2O_2(aq)$ is used in Experiment (2). Which of the following combinations is correct ?

	Rate of formation of $O_2(g)$ at the start	Total volume of $O_2(g)$ formed
A.	Experiment (1) > Experiment (2)	Experiment (1) = Experiment (2)
B.	Experiment (1) > Experiment (2)	Experiment (1) > Experiment (2)
C.	Experiment (1) = Experiment (2)	Experiment (1) = Experiment (2)
D.	Experiment (1) = Experiment (2)	Experiment (1) > Experiment (2)

26. Consider the information below :

Reaction	Equilibrium constant at 25°C
$A(aq) + B(aq) \rightleftharpoons C(aq) + D(aq)$	K_1
$C(aq) + D(aq) \rightleftharpoons E(aq) + F(aq) + G(aq)$	K_2
$E(aq) + F(aq) + G(aq) \rightleftharpoons A(aq) + B(aq)$	K_3

Which of the following combinations is correct ?

	Relationship of K_1, K_2 and K_3	Unit of K_3
A.	$K_3 = \frac{1}{K_1 \times K_2}$	$mol\ dm^{-3}$
B.	$K_3 = \frac{1}{K_1 \times K_2}$	$mol^{-1}\ dm^3$
C.	$K_3 = K_1 \times K_2$	$mol\ dm^{-3}$
D.	$K_3 = K_1 \times K_2$	$mol^{-1}\ dm^3$

27. Which of the following combinations concerning $CH_3CH{=}CHCH_2CH(C_2H_5)_2$ is correct ?

	Number of geometrical isomers	Number of enantiomers
A.	2	4
B.	2	2
C.	0	2
D.	2	0

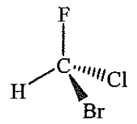
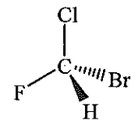
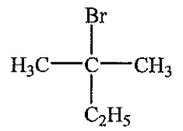
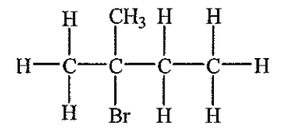
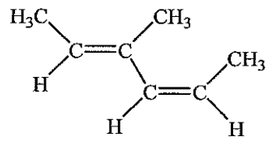
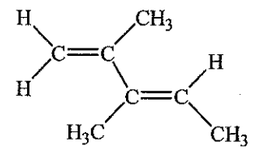
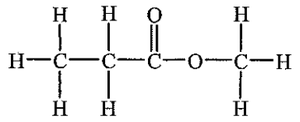
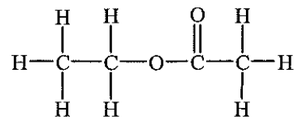
28. Consider the following organic reactions where **P**, **Q** and **R** are the major organic products formed.

$$CH_3CH_2CH{=}CH_2 \xrightarrow{HBr(g)} \mathbf{P} \xrightarrow{NaOH(aq)} \mathbf{Q} \xrightarrow{K_2Cr_2O_7(aq)\,/\,H^+(aq)} \mathbf{R}$$

Which of the following combinations is correct ?

	P	**Q**	**R**
A.	$CH_3CH_2CHBrCH_3$	$CH_3CH_2CH(OH)CH_3$	$CH_3CH_2COCH_3$
B.	$CH_3CH_2CH_2CH_2Br$	$CH_3CH_2CH_2CH_2OH$	$CH_3CH_2CH_2CHO$
C.	$CH_3CH_2CH_2CH_2Br$	$CH_3CH_2CH{=}CH_2$	$CH_3CH_2CH(OH)CH_2OH$
D.	$CH_3CH_2CHBrCH_3$	$CH_3CH_2CH(OH)CH_3$	$CH_3CH_2CO_2H$

29. In which of the following options are molecule **Y** and molecule **Z** identical ?

	Molecule **Y**	Molecule **Z**
A.		
B.		
C.		
D.		

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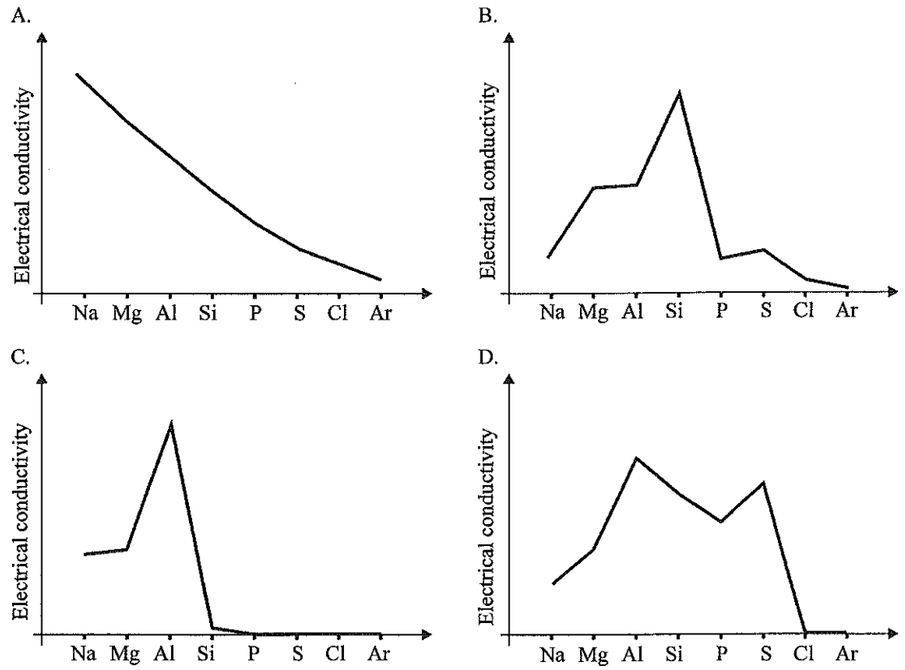
30. Which of the following graphs (not drawn to scale) correctly shows the variation in electrical conductivity of the elements in the third period of the Periodic Table at room temperature ?



31. The following system attained equilibrium at a certain temperature :

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

Which of the following statements is / are correct when the volume of the system is decreased while the temperature remains unchanged ?

(1) The value of K_c increases.
(2) The equilibrium position shifts to the right.
(3) The rate of decomposition of $SO_3(g)$ increases.

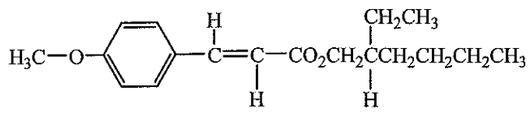
A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

32. Which of the following statements concerning aspirin is / are correct ?

(1) It undergoes esterification with ethanoic acid in the presence of an acid catalyst.
(2) It reacts with sodium carbonate solution to give a colourless gas.
(3) It can be used to reduce inflammation.

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

33. A sunblock cream contains the compound below as the active ingredient :

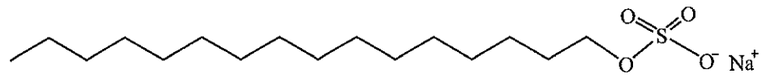


Which of the following reagents can react with this compound ?

(1) NaOH(aq)
(2) $PCl_3(l)$
(3) acidified $KMnO_4(aq)$

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

34. The structure of a detergent is shown below :



Which of the following statements concerning the detergent are correct ?

(1) It has a cleaning function in hard water.
(2) Vigorous shaking it with oil and water can form a stable emulsion.
(3) It can be formed by reacting a certain vegetable oil with NaOH(aq).

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

Directions : Each question below (Questions 35 and 36) consists of two separate statements. Decide whether each of the two statements is true or false; if both are true, then decide whether or not the second statement is a *correct* explanation of the first statement. Then select one option from A to D according to the following table :

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.

	1st statement	**2nd statement**
35.	At chemical equilibrium state, the forward reaction rate equals zero.	At chemical equilibrium state, the reactants would not react to give the products.
36.	Aluminium oxide is soluble in water.	Aluminium oxide is an amphoteric oxide.

END OF SECTION A