Jockey Club Ti-I College

First Term Examination 2013-14

Subject Group: X1 / X2 Class: _____ ( ) Name: _____

FORM 6 CHEMISTRY PAPER 1

12th December, 2013

8:30 am – 11:00 am (150 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 22 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.
2. When told to open this book, you should check that all 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.

This section consists of two parts. There are 24 questions in PART 1 and 12 questions in PART II.
Choose the best answer for each question.
Candidates may refer to the Periodic Table printed on page 22 of Question-Answer Book B.

PART I

1. Which of the following statements about limestone is/are correct?
   (1) It gives a golden yellow flame in a flame test.
   (2) It gives a colourless gas when heated strongly.
   (3) It dissolves in dilute sulphuric acid to give a clear solution.
   A. (1) only
   B. (2) only
   C. (1) and (3) only
   D. (2) and (3) only

2. Element X occurs in nature in two isotopes, ^{69}X and ^{71}X. The table below lists the relative abundance of each isotope :

Isotope	Relative abundance (%)
^{69}X	60.0
^{71}X	40.0

   What is the relative atomic mass of X?
   A. 69.6
   B. 69.8
   C. 70.0
   D. 70.2

3. Which of the following statements best describes metallic bonding?
   A. It is an attractive force between ions.
   B. It is an attractive force between polar chemical species.
   C. It is an attractive force between atomic nuclei and bond-pair electrons.
   D. It is an attractive force between cations and delocalized electrons.

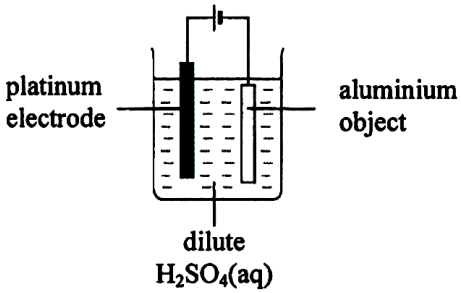
4. Which of the following species shown below does NOT follow the 'octet rule'?
   A. Na_2O
   B. MgO
   C. PCl_3
   D. SCl_4

5. X, Y and Z are three different metals. When these metals are placed separately into an aqueous solution of tin(II) nitrate, a spongy layer of tin is formed only on X. When each of the oxides of these metals is heated strongly, only the oxide of Y gives a metallic lustre. Which of the following represents the arrangement of these metals in decreasing order of reactivity?
   A. X>Y>Z
   B. X>Z>Y
   C. Y>X>Z
   D. Z>X>Y

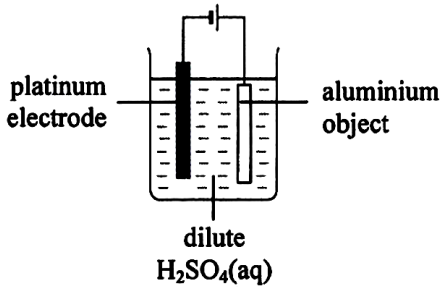
6. Which of the following statements concerning an aluminium ore consisting mainly Al_2O_3 is correct?
   (Relative atomic masses : O = 16.0, Al = 27.0)
   A. Carbon can be used to extract aluminium from this ore.
   B. The abundance of this ore in the earth crust is very low.
   C. This ore contains more than 55% of aluminium by mass.
   D. Aluminium can be extracted from this ore due to the advancement of technology in applying electricity.

7. Which of the set-ups shown below can best be used to anodize an aluminium object?

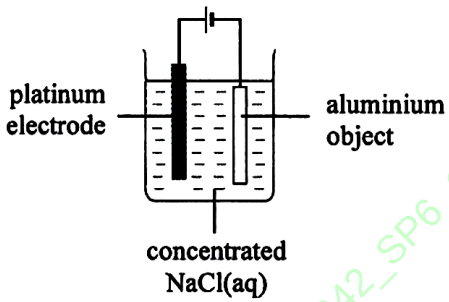
A.



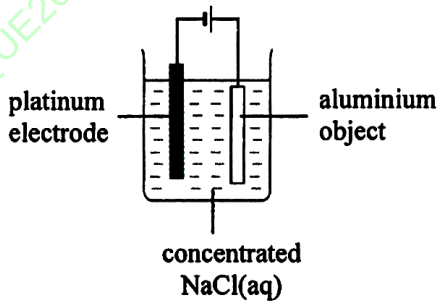
B.



C.



D.



8. In which of the following processes would a colourless gas evolve?
   (1) Magnesium is added to dilute sulphuric acid.
   (2) Ammonium chloride is heated with calcium hydroxide.
   (3) Water is added to a solid mixture of citric acid and sodium hydrogencarbonate.
   A. (1) and (2) only
   B. (1) and (3) only
   C. (2) and (3) only
   D. (1), (2) and (3)

9. A salt has the formula $(NH_4)_2SO_4 \cdot FeSO_4 \cdot 6H_2O$. Which of the following is/are the expected observation(s) when an aqueous solution of this salt is treated with aqueous NaOH solution?
   (1) formation of a dirty green precipitate
   (2) formation of a brown precipitate
   (3) evolution of a gas with a pungent odour
   A. (1) only
   B. (2) only
   C. (1) and (3) only
   D. (2) and (3) only

10. Solid Y is soluble in cold water. When an aqueous solution Y is added separately to sodium hydroxide solution and to acidified silver nitrate solution, a white precipitate is formed in both cases. Which of the following compounds might Y be?
   A. ammonium carbonate
   B. zinc carbonate
   C. lead(II) chloride
   D. magnesium chloride

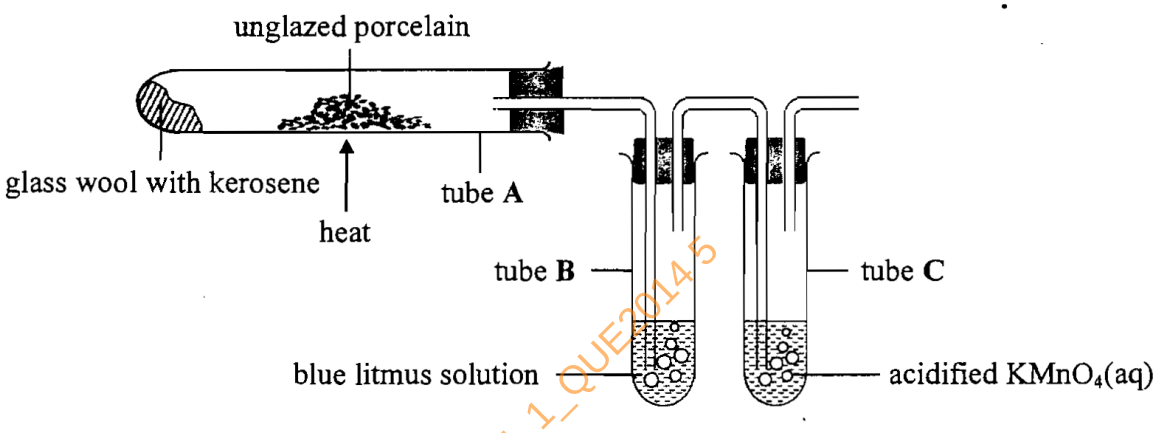
11. At 298 K, the pH of 0.10 mol dm^{-3} HCl(aq) is 1. Which of the following statements is correct?
   A. At 298 K, the pH of 0.20 mol dm^{-3} HCl(aq) is 2.
   B. At 298 K, the pH of 0.20 mol dm^{-3} HCl(aq) is 0.5.
   C. At 298 K, the pH of 0.01 mol dm^{-3} HCl(aq) is 2.
   D. At 298 K, the pH of 0.01 mol dm^{-3} HCl(aq) is 0.1.

12. Compound X has the following structure:

   $CH_2=CHCH_2OH$

   The systematic name of X is
   A. prop-1-en-3-ol.
   B. prop-2-en-1-ol.
   C. 3-hydroxypropene.
   D. 1-hydroxyprop-3-ene.

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

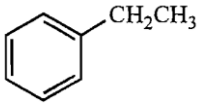


The unglazed porcelain in tube A is strongly heated and the glass wool is occasionally heated. Which of the following statements is / are correct?

(1) A chemical reaction occurs at the glass wool.
(2) There is NO colour change in the solution in tube B.
(3) There is NO colour change in the solution in tube C.

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

14. Which of the following compounds can be used as monomers to make addition polymers?

(1) $CF_2=CF_2$ (2) $CH_2=C(CH_2CH_3)CN$ (3) 

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

15. Ammonia is very soluble in water. Which of the following statements best accounts for this phenomenon?

A. Both ammonia molecule and water molecule are polar.
B. Ammonia molecule and water molecule are of comparable sizes.
C. Ammonia undergoes ionization in water.
D. Ammonia forms hydrogen bond with water.

16. Which of the following molecules is planar?
    A. BF_3
    B. NH_3
    C. CH_4
    D. PCl_5

17. Which of the following statements about lithium-ion batteries is/are correct?
    (1) In lithium-ion batteries, the electrolyte is lithium salt in water.
    (2) Lithium-ion batteries are rechargeable.
    (3) The disposal of lithium-ion batteries causes less harm to the environment than that of nickel-cadmium batteries.
    A. (1) only
    B. (2) only
    C. (1) and (3) only
    D. (2) and (3) only

18. Which of the following is/are secondary cell(s)?
    (1) alkaline manganese cell
    (2) lithium ion cell
    (3) nickel metal hydride cell
    A. (1) only
    B. (2) only
    C. (1) and (3) only
    D. (2) and (3) only

19. Which of the following processes involve redox reaction?
    (1) mixing methanol and ethanol
    (2) mixing chlorine and methane under sunlight
    (3) mixing ethene and acidified $KMnO_4(aq)$
    A. (1) and (2) only
    B. (1) and (3) only
    C. (2) and (3) only
    D. (1), (2) and (3)

20. Consider the following chemical equation:

$$\boldsymbol{p}SO_2(aq) + \boldsymbol{q}Ce^{4+}(aq) + \boldsymbol{r}H_2O(l) \rightarrow \boldsymbol{p}SO_4^{2-}(aq) + \boldsymbol{q}Ce^{3+}(aq) + 2\boldsymbol{r}H^+(aq)$$

(Ce is the chemical symbol for cerium.)

Which of the following combination is correct?

	p	***q***	***r***
A.	1	1	1
B.	1	1	2
C.	1	2	2
D.	2	1	2

21. When 25 cm^3 of 1.00 mol dm^{-3} NaOH(aq) is mixed with 25 cm^3 of 1.00 mol dm^{-3} HCl(aq), the temperature of the mixture rises by 6°C. Which of the following reactants, when mixed under the same conditions, would give a similar temperature rise?

A. 25 cm^3 of 2.00 mol dm^{-3} NaOH(aq) and 25 cm^3 of 2.00 mol dm^{-3} HCl(aq)
B. 50 cm^3 of 1.00 mol dm^{-3} NaOH(aq) and 50 cm^3 of 1.00 mol dm^{-3} HCl(aq)
C. 50 cm^3 of 0.50 mol dm^{-3} NaOH(aq) and 50 cm^3 of 0.50 mol dm^{-3} HCl(aq)
D. 100 cm^3 of 0.25 mol dm^{-3} NaOH(aq) and 100 cm^3 of 0.25 mol dm^{-3} HCl(aq)

22. Under standard conditions, complete combustion of 0.050 mol propane (C_3H_8) gives 111 kJ of heat. Which of the following is the standard enthalpy change of formation of propane?

(Standard enthalpy change of formation of $H_2O(l)$ = –286 kJ mol^{-1};
standard enthalpy change of formation of $CO_2(g)$ = –394 kJ mol^{-1})

A. –106 kJ mol^{-1}
B. +106 kJ mol^{-1}
C. –569 kJ mol^{-1}
D. +569 kJ mol^{-1}

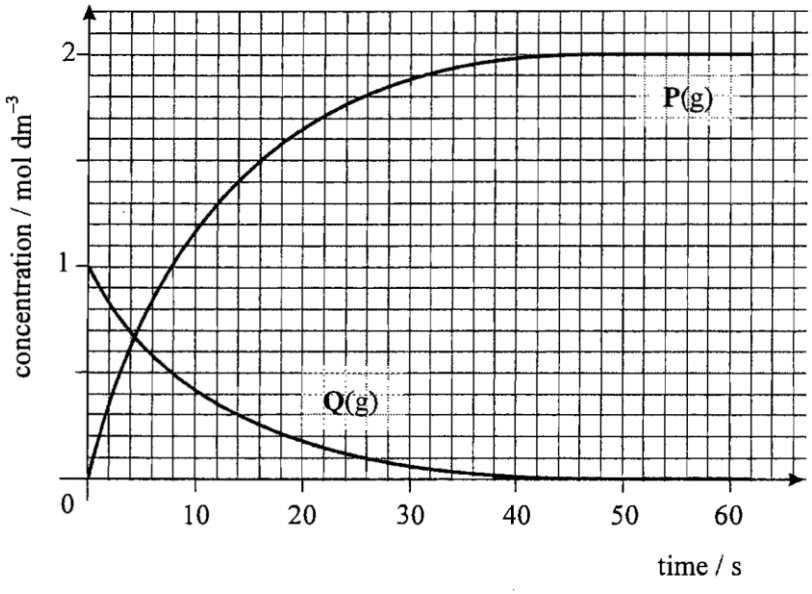
Directions: Each question below (Questions 23 to 24) consists of two separate statements. Decide whether each of the two statements is true or false; if both are true, then decide whether or not the second statement is a *correct* explanation of the first statement. Then select one option from A to D 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 and 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**
23.	Burning fossil fuels can cause acid rain.	Burning fossil fuels produces carbon dioxide.
24.	The boiling point of hydrogen chloride is higher than that of hydrogen fluoride.	The molecular size of hydrogen chloride is greater than that of hydrogen fluoride.

PART II

25. The concentration-time graph for a certain chemical reaction in a closed vessel of fixed volume is shown below:



Which of the following chemical equations correctly represents the reaction?

A. P(g) → Q(g)
B. Q(g) → P(g)
C. P(g) → 2Q(g)
D. Q(g) → 2P(g)

26. For which of the following can their progress of reaction be followed by colorimetry?

(1) $2MnO_4^-(aq) + 5C_2O_4^{2-}(aq) + 16\ H^+(aq) \rightarrow 2Mn^{2+}(aq) + 10CO_2(g) + 8H_2O(l)$
(2) $SO_3^{2-}(aq) + 2H^+(aq) \rightarrow SO_2(g) + H_2O(l)$
(3) $Br_2(aq) + HCO_2H(aq) \rightarrow 2Br^-(aq) + CO_2(g) + 2H^+(aq)$

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

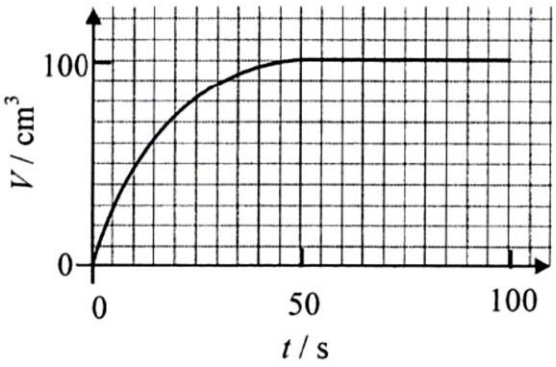
27. What is the theoretical volume of carbon dioxide that can be obtained, at room temperature and pressure, when 1.2 g of $Na_2CO_3(s)$ reacts with 50 cm^3 of 1.0 M HNO_3?
(Molar volume of gas at room temperature and pressure = 24 dm^3;
Relative atomic masses: H = 1.0, C = 12.0, N = 14.0, O = 16.0, Na = 23.0)

A. 272 cm^3
B. 544 cm^3
C. 600 cm^3
D. 1200 cm^3

28. In an experiment to study the rate of the following reaction, a small amount of powdered calcium carbonate was added to excess hydrochloric acid and the volume of gas liberated was recorded.

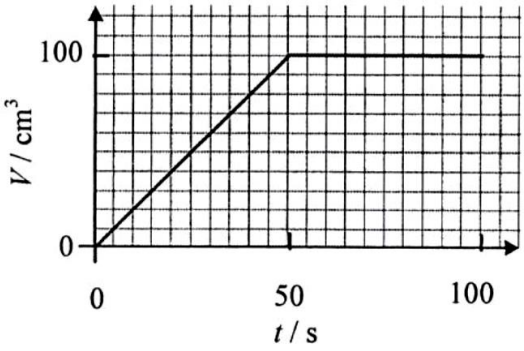
$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$

The graph below shows the volumes of gas liberated (V) at different times (t) during the experiment:

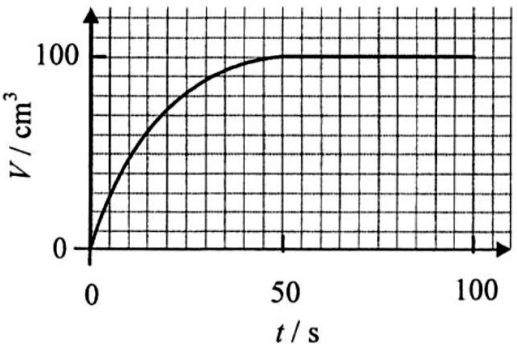


The experiment was repeated under the same conditions using the same mass of calcium carbonate granules instead of powdered calcium carbonate. Which of the following graphs would best represent the results obtained in the repeated experiment?

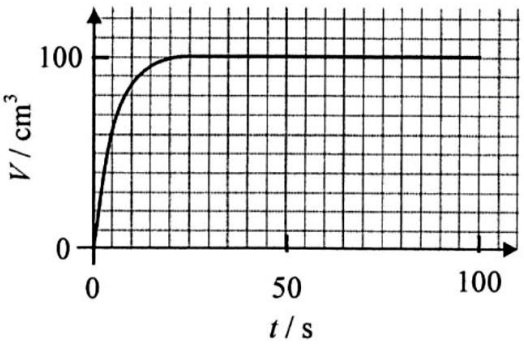
A.



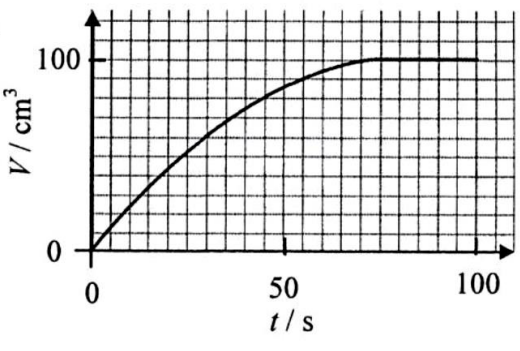
B.



C.



D.

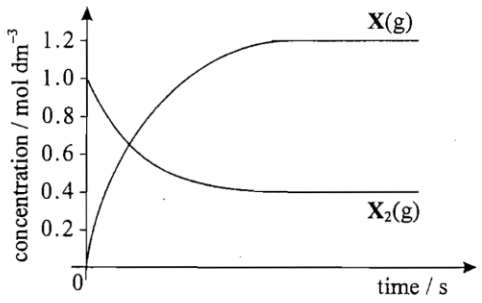


29. In a 1 dm^3 closed container, 1 mole $X_2(g)$ undergoes decomposition to form X(g) until equilibrium is attained. The chemical equation concerned is shown below:

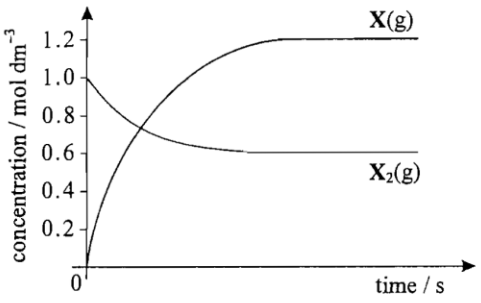
$$\mathbf{X}_2(g) \rightleftharpoons 2\mathbf{X}(g)$$

Which of the following graphs correctly shows the variation in concentrations of $X_2(g)$ and X(g) with time?

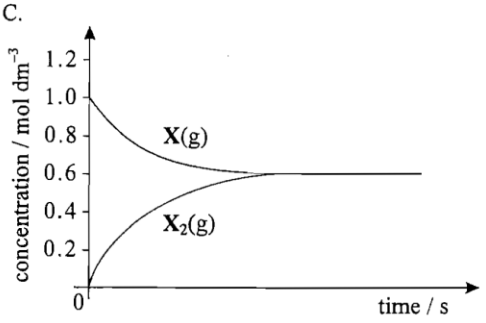
A.



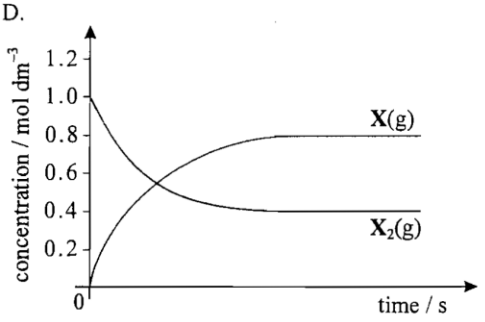
B.



C.



D.



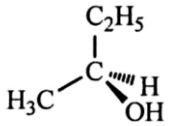
30. Which of the following is/are characteristic(s) of chemical equilibrium?
    (1) When a catalyst is added to an equilibrium mixture, the equilibrium position changes.
    (2) When equilibrium is attained, the rate of forward reaction and that of backward reaction are equal.
    (3) Equilibrium can be attained from either direction of the reaction.
    A. (1) only
    B. (2) only
    C. (1) and (3) only
    D. (2) and (3) only

31. Consider the isomeric compounds shown below:

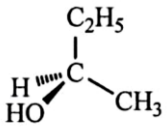
$$CH_3COCH_3 \quad \text{and} \quad CH_3CH_2CHO$$

Which of the following reagents can be used to distinguish between the two compounds ?
    A. acidified potassium dichromate solution
    B. lithium aluminium hydride
    C. dilute sulphuric acid
    D. pH indicator

32. The three-dimensional structure of a molecule of compound X and that of compound Y are shown below:



X



Y

Which of the following statements about X and Y are correct?

A. X and Y are identical.
B. X and Y are a pair of structural isomers.
C. A mixture of X and Y can be separated by fractional distillation.
D. X and Y have the same standard enthalpy change of combustion.

33. Consider the following organic conversion:

$$(CH_3)_3COH \xrightarrow{X} (CH_3)_3CCl$$

Which of the following reagents can X be ?

(1) $Cl_2(g)$
(2) $PCl_3(l)$
(3) Concentrated HCl(aq)

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

34. Which of the following is NOT a characteristic property of transition metals?

A. They form coloured compounds.
B. They exhibit variable oxidation numbers in their compounds.
C. They react with dilute hydrochloric acid to give hydrogen gas.
D. They exhibit catalytic property in elemental state or as compounds

Directions: Each question below (Questions 35 to 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 and 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.	Increasing reaction temperature can increase the yield for all reversible chemical reactions.	Increasing reaction temperature can shorten the time needed to attain equilibrium for all reversible chemical reactions.
36.	The melting point of the non-metals in Period 3 of the Periodic Table decrease from sulphur to argon.	The relative atomic mass increase from sulphur to argon in Period 3 of the Periodic Table.

END OF SECTION A

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Jockey Club Ti-I College

First Term Examination 2013-14

Subject Group: X1 / X2 Class: _____ ( ) Name: _____

FORM 6 CHEMISTRY PAPER 1

SECTION B: Question-Answer Book B

12th December, 2013

8:30 am – 11:00 am (150 minutes)

This paper must be answered in English.

INSTRUCTIONS FOR SECTION B

(1) Write your subject group, class, class number and name in the space provided on Page 1 of this Question-Answer Book.

(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. Write your answers in the spaces provided in this Question-Answer Book.

(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 subject group, class, class number and name on each sheet, and fasten with string INSIDE this Question-Answer Book.

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

PART I

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

1. Both BF_3 and NH_3 exist as simple molecules.

   (a) For each of these molecules, draw its three-dimensional structure.

   BF_3

   NH_3

   (2 marks)

   (b) For each of these molecules, explain whether or not it is polar.

   (2 marks)

   (c) BF_3 reacts with NH_3 to give F_3BNH_3. With the aid of an appropriate diagram, describe the bond formation between BF_3 and NH_3.

   (3 marks)

2. Compound ***W*** contains carbon, hydrogen and oxygen only. The relative molecular mass of ***W*** is 88.0. Complete combustion of 1.32 g of ***W*** gives 2.64 g of carbon dioxide and 1.08 g of water.

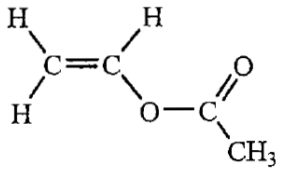
(a) Deduce the molecular formula of ***W***.
(Relative atomic masses: H = 1.0, C=12.0, O = 16.0)

(3 marks)

(b) Given that ***W*** has only one functional group, draw TWO possible structures of ***W***.

(2 marks)

3. Poly(ethenyl ethanoate) is a polymer. Its monomer is ethenyl ethanoate with the structure shown below.



(a) Ethene is the raw material used in making ethenyl ethanoate. Ethene can be produced from hydrocarbons of higher molecular mass by an important industrial process.

(i) Name this industrial process.

(ii) Explain why this process is important.

(2 marks)

(b) Draw the structure of poly(ethenyl ethanoate).

(1 mark)

(c) Ethyl ethanoate is an organic solvent.

(i) Draw the structure of ethyl ethanoate.

(ii) Suggest a chemical test to show how to distinguish between ethenyl ethanoate and ethyl ethanoate.

(3 marks)

4. An experiment on the preparation of hydrated zinc sulphate involves the following five steps:

Step 1: Warm 30 cm^3 of dilute sulphuric acid in a beaker. Add zinc oxide to the acid until in excess.

Step 2: Filter the reaction mixture and collect the filtrate.

Step 3: Heat the filtrate until it becomes saturated. Then allow it to cool to room temperature to crystallise out hydrated zinc sulphate.

Step 4: Filter off the crystals formed, and then wash them with a little amount of cold distilled water.

Step 5: Dry the crystals.

(a) For Step 1,

(i) write the chemical equation for the reaction that occurs,

(ii) suggest how one can know that zinc oxide is in excess, and

(iii) explain why zinc oxide rather than sulphuric acid is used in excess.

(3 marks)

(b) Suggest ONE way to show that a saturated solution has been obtained in Step 3.

(1 mark)

(c) Explain why **a little amount of cold distilled water** is used to wash the crystals in Step 4.

(2 marks)

(d) Suggest ONE way of drying the crystals in Step 5.

(1 mark)

(e) Suggest ONE chemical that can be used to replace zinc oxide in this experiment. Write a chemical equation for the reaction between this chemical and dilute sulphuric acid in Step 1.

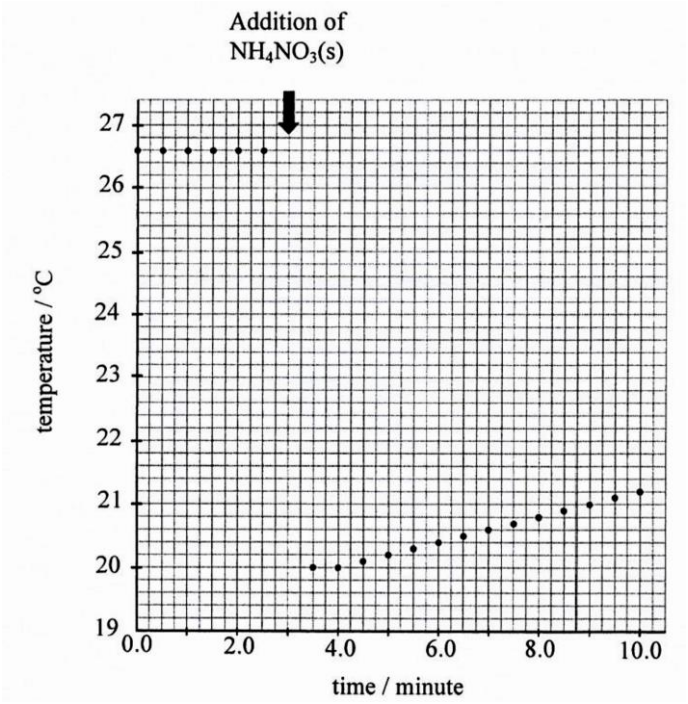
(2 marks)

5. The following experiment was carried out to determine the enthalpy change of solution of ammonium nitrate:

$$NH_4NO_3(s) \xrightarrow{H_2O(l)} NH_4NO_3(aq)$$

A certain volume of water was placed in an expanded polystyrene cup. The temperature of the water in the cup was measured with a thermometer at half-minute intervals. Right at the third minute, 2.0 g of $NH_4NO_3(s)$ was added to the cup. The solution in the cup was then stirred thoroughly and its temperature was measured for an additional 7 minutes.

The recordings of temperature are shown in the graph below:



(a) (i) From the graph, estimate the greatest temperature drop of the solution in the cup.

(ii) The mass of the $NH_4NO_3(aq)$ obtained was found to be 21.8 g. Calculate the enthalpy change of solution of ammonium nitrate, in kJ mol^{-1}, under the experimental conditions.
(Assume that the heat capacity of the expanded polystyrene cup is negligible, and the specific heat capacity of the $NH_4NO_3(aq)$ obtained is 4.3 J g^{-1} K^{-1}.)

(4 marks)

(b) Suggest ONE way of keeping $NH_4NO_3(s)$ dry during storage.

(1 mark)

*6. Briefly describe how polypropene can be produced from naphtha. (4 marks)

7. Both caesium (Cs) and sodium (Na) are elements in Group I of the Periodic Table. Caesium reacts with chlorine to form caesium chloride.

(a) Write the chemical equation for the reaction of caesium with chlorine.

(1 mark)

(b) Solid caesium chloride has a giant ionic structure.

(i) Draw a diagram to show the structure of caesium chloride.

(ii) Explain why solid caesium chloride is brittle.

(3 marks)

(c) Predict, with ONE reason, whether sodium or caesium is more reactive towards chlorine.

(1 mark)

8. The photograph below shows a laptop computer which is powered by Direct Methanol Fuel Cell (DMFC).

The operation of DMFC is based on the following reaction under an acidic condition:

$2CH_3OH(aq) + 3O_2(g) \rightarrow 2CO_2(g) + 4H_2O(l)$

(a) Write half-equations for the anodic and cathodic reactions when DMFC is producing a current.

anodic reaction

cathodic reaction

(2 marks)

(b) A concentrated aqueous methanol solution is used as the fuel in DMFC.

(i) Suggest why pure methanol is NOT used.

(ii) Circle TWO of the following hazard warning labels that should be displayed on the container of a concentrated aqueous methanol solution.


CORROSIVE 腐蝕性


TOXIC 有 毒


FLAMMABLE 易 燃

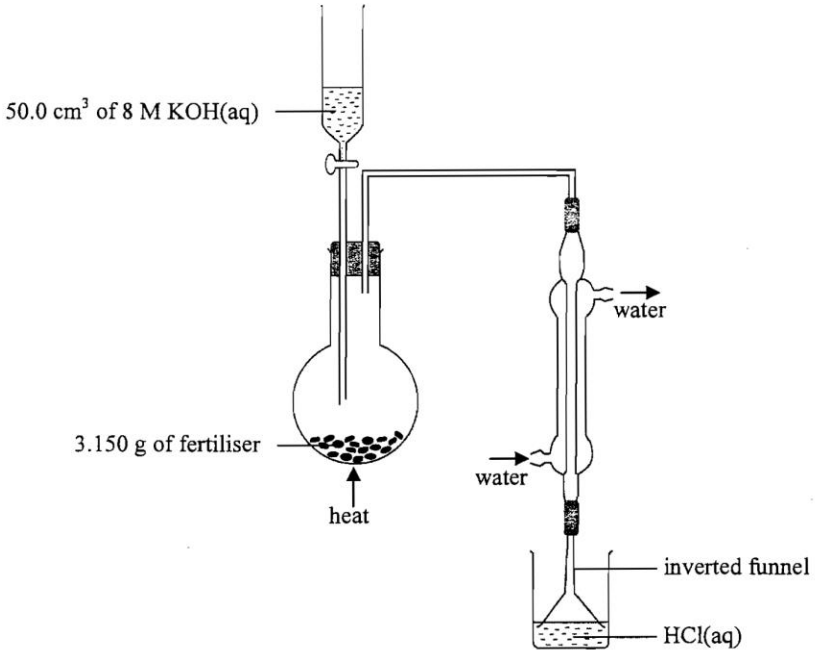

OXIDISING 氧化性

(2 marks)

8. (c) Would you expect DMFC to be widely used in powering laptop computers? Explain your answer.

(2 marks)

9. A fertiliser only contains ammonium nitrate (NH_4NO_3) and potassium chloride (KCl). An experiment was performed to determine the percentage by mass of NH_4NO_3 in this fertiliser. The set-up used is shown below:



The KOH(aq) was added slowly to the fertiliser and the mixture formed was heated gently. The ammonia liberated from the reaction between NH_4NO_3 and KOH was first cooled in a condenser, and then passed through an inverted funnel to a solution containing 0.0485 mol HCl. The solution was finally made up to 100.00 cm^3 and labelled '**S**'.

(a) Write an ionic equation for the reaction between NH_4NO_3 and KOH.

(1 mark)

(b) Suggest the potential hazard of one of the chemicals used.

(1 mark)

(c) Given that ammonia is very soluble in water, state the advantage of using an inverted funnel.

(1 mark)

9. (d) 25.00 cm^3 of '**S**' was transferred to a conical flask, and then titrated with 0.100 M NaOH(aq) using methyl orange as an indicator. 41.00 cm^3 of the NaOH(aq) was required to reach the end point.

(i) Name the apparatus that should be used to transfer 25.00 cm^3 of '**S**'.

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

(iii) Calculate the percentage by mass of NH_4NO_3 in this fertiliser.
(Molar mass of NH_4NO_3 = 80.0 g)

(5 marks)

(e) Suggest a test to show the presence of a potassium-containing compound in the fertiliser.

(1 mark)

PART II

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

10. Safety airbags are important devices installed in vehicles. During a serious car crash, the chemicals in the airbag immediately react to release a large amount of gas. An airbag hence inflates instantly, protecting the passenger. The main chemicals in safety airbags are sodium azide (NaN_3) and potassium nitrate (KNO_3). The equations below show the reactions involved when an airbag is inflated:

$2NaN_3(s) \rightarrow 2Na(s) + 3N_2(g)$

$10Na(s) + 2KNO_3(s) \rightarrow K_2O(s) + 5Na_2O(s) + N_2(g)$

(a) Explain why the $NaN_3(s)$ and $KNO_3(s)$ used in the airbags are in the form of fine powder.

(1 mark)

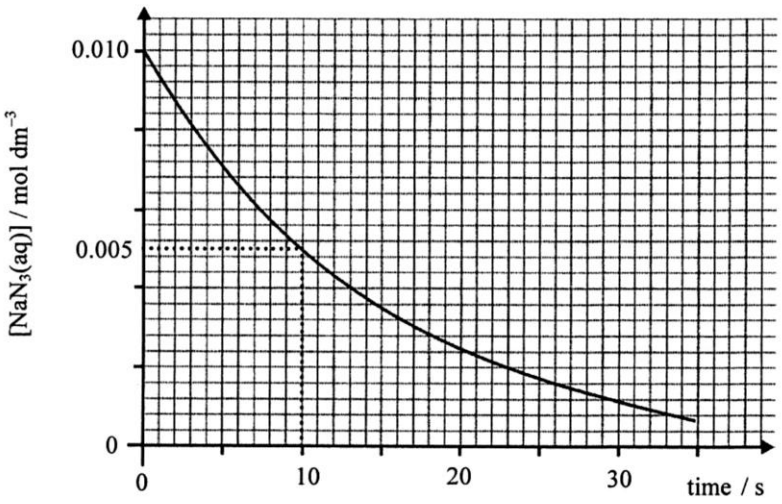
(b) An airbag contains 100.0 g of $NaN_3(s)$ and 200.0 g of $KNO_3(s)$. Calculate the theoretical volume, measured at room temperature and pressure, of the gas produced when the bag is inflated.
(Formula masses: NaN_3 = 65.0, KNO_3 = 101.1;
molar volume of gas at room temperature and pressure = 24 dm^3)

(3 marks)

(c) The main function of $NaN_3(s)$ is to produce $N_2(g)$ for inflating the airbags. Suggest why it is necessary to include $KNO_3(s)$ in the airbags.

(1 mark)

10. (d) Sodium azide is a toxic chemical. Thus any NaN_3 waste remained during the manufacture of safety airbags needs special treatment before disposal. The treatment involves first dissolving NaN_3 in water, and then reacting the solution formed with excess nitrous acid, $HNO_2(aq)$. The graph below shows the variation of concentration of $NaN_3(aq)$ in the reaction mixture with time in one such process:

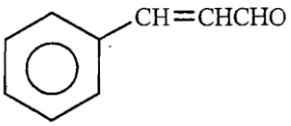


(i) Calculate the average rate of consumption of $NaN_3(aq)$ in the first 10 seconds.

(ii) Suggest how the instantaneous rate of consumption of $NaN_3(aq)$ at the 10th second can be determined from the graph.

(3 marks)

11. Cinnamon, which can be used a flavouring, contains cinnamaldehyde (C_9H_8O). The structure of cinnamaldehyde is shown below:



(a) Draw the *trans*-isomer for the above structure.

(1 mark)

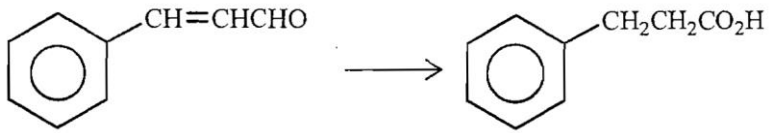
(b) Explain why ethyl ethanoate is a better solvent than water for dissolving cinnamaldehyde.

(1 mark)

(c) In an experiment to extract cinnamaldehyde from cinnamon, a solution containing only ethyl ethanoate and cinnamaldehyde is obtained after a series of steps. In order to separate these two compounds, simple distillation can be carried out. Draw a diagram for the set-up involved, and label the name of the distillate collected.
(Boiling points: cinnamaldehyde = 248 ^{o}C, ethyl ethanoate = 77 ^{o}C)

(2 marks)

11. (d) 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 structure of the organic product.



(2 marks)

12. Consider the reaction represented by the equation below:

$$Fe^{3+}(aq) + SCN^{-}(aq) \rightleftharpoons Fe(SCN)^{2+}(aq)$$

In an experiment, 25.0 cm^3 of 0.010 M $Fe_2(SO_4)_3(aq)$ and 25.0 cm^3 of 0.010 M KSCN(aq) were mixed in a conical flask at room temperature, and equilibrium was attained.

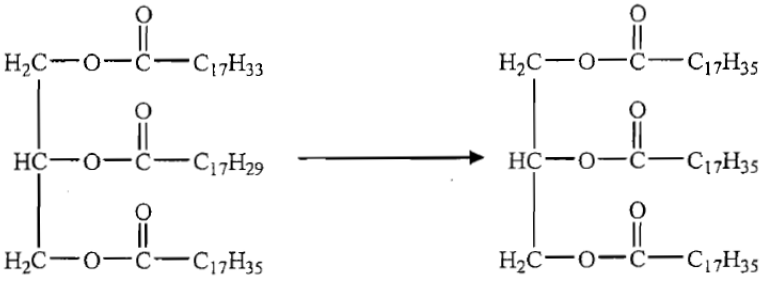
(a) The concentration of $Fe(SCN)^{2+}(aq)$ in the mixture was 0.0043 M when equilibrium was attained. Calculate the equilibrium constant K_c for the above reaction at room temperature.

(3 marks)

(b) It is known that $FePO_4(s)$ is insoluble in water. Suggest what would be the effect on the equilibrium position if $Na_3PO_4(s)$ is added to the equilibrium mixture.

(1 mark)

13. The diagram below shows the conversion of an oil molecule ***P*** to a fat molecule ***Q***.



P ***Q***

(a) (i) Given that all alkyl groups in both ***P*** and ***Q*** are straight chains, label the chiral carbon(s) by using '*******' in the above diagram.

(ii) With reference to (i), explain whether a change in optical activity is involved in the above conversion.

(2 marks)

*(b) One of the products in the alkaline hydrolysis of ***Q*** has a cleansing property. Explain the cleansing property of this product. (4 marks)

14. Consider the following oxides :

Na_2O MgO Al_2O_3 SiO_2 P_4O_{10} SO_2 Cl_2O

(a) Which of the above oxides listed above can conduct electricity in molten state?

(1 mark)

(b) Explain why SiO_2 has the highest melting point among the covalent oxides listed above.

(2 marks)

(c) Write a chemical equation for the reaction between $Al_2O_3(s)$ and NaOH(aq).

(1 mark)

END OF SECTION B

END OF PAPER

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PERIODIC TABLE 週期表

GROUP 族

atomic number 原子序

relative atomic mass 相對原子質量

I	II											III	IV	V	VI	VII	0
				1 **H** 1.0													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)