IONA PRESENTATION COLLEGE

Year 12 Chemistry

Semester One Examination, 2003

Student Name : _____

TIME ALLOWED FOR THIS PAPER

Reading time before commencing work: Ten minutes

Working time for paper: Three hours

MATERIAL REQUIRED/RECOMMENDED FOR THIS PAPER

TO BE PROVIDED BY THE SUPERVISOR

This Question Paper/Answer Booklet
Separate Multiple Choice Answer Sheet
Chemistry/Data Sheet (inside front cover of this Question/Answer booklet)

TO BE PROVIDED BY THE CANDIDATE

Standard Items: Pens, pencils, eraser or correction fluid, ruler
Special Items: Calculators satisfying the conditions set by the Curriculum Council and a 2B, B or
                      HB pencil for the separate Multiple Choice Answer Sheet.

IMPORTANT NOTE TO CANDIDATES

It is your responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor BEFORE reading any further.

STRUCTURE OF THIS PAPER

Part	Format	No. of Questions Set	No. of Questions to be Attempted	Marks Allocated	Recommended Time (Approx) /Minutes
1.	Multiple choice	30	ALL	60 (30%)	55
2.	Short answers	11	ALL	70 (35%)	60
3.	Calculations	5	ALL	50 (25%)	45
4.	Extended answers	2	1	20 (10%)	20

Total marks for paper = 200 (100%)

INSTRUCTIONS TO CANDIDATES

Reading Time: The examiners recommend that candidates spend the reading time mainly reading the Instructions to Candidates and Parts 2, 3 and 4.

Part 1 — Multiple Choice

Answer **ALL** questions, using a pen, on the separate Multiple Choice Answer Sheet.

If you consider that two or more of the alternative responses are correct, choose the one you think is best. If you think you know an answer, mark it even if you are not certain you are correct. Marks will **not** be deducted for incorrect answers.

FEEL FREE TO WRITE OR DO WORKING ON THE QUESTION PAPER; many students who score high marks in the Multiple Choice Section do this.

Parts 2, 3 and 4

Use a ballpoint or ink pen. **Do not** answer in pencil. Write your answers in this Question/Answer Booklet.

Questions containing specific instructions to show working should be answered with a complete, logical, clear sequence of reasoning showing how the final answer was arrived at; correct answers which do not show working will not be awarded full marks.

CHEMICAL EQUATIONS

For full marks, chemical equations should refer only to those species consumed in the reaction and the new species produced. These species may be **ions** [for example Ag^+(aq)], **molecules** [for example NH_3, (g), NH_3(aq), CH_3COOH(*l*), CH_3COOH(aq)] or **solids** [for example $BaSO_4$(s), Cu(s), Na_2CO_3(s)].

PART 1 – MULTIPLE CHOICE

(60 marks = 30% of the total)
Answer **ALL** questions in Part 1 on the Separate Multiple Choice Answer Sheet provided.

1.   In which one of the following pairs do both species have the same electron configuration?

   (a)   Na and K
   (b)   Na and Mg
   (c) Na^+ and Ar
   (d) Na^+ and Ne

2.   An atom has the first five successive ionization energies

          1.1   2.4   4.6   6.2   37.8   MJ mol $^{-1}$
   Which of the following elements is it?

   (a)   Aluminium
   (b)   Argon
   (c)   Carbon
   (d)   Sodium

3.   Which of the following properties generally decreases when going across a row of the Periodic Table from Group I to Group VII?.

   (a)   Oxidising ability
   (b)   The acidity of the oxides
   (c)   The tendency of the element to form positive ions
   (d)   Electronegativity

4.   Which of the following is a linear molecule?

   (a) H_2S
   (b) C_2H_2
   (c) SO_2
   (d) SO_3

5.   Which one of the following molecules is non-polar; that is, the molecule has no overall dipole moment

   (a) H_2CO
   (b) CO_2
   (c) NH_3
   (d) SO_2

6.   Which of the following **best** explains why hexane has a very <u>low</u> solubility in water?

   (a)   Hexane and water each have strong forces between their molecules.
   (b)   Like dissolves like, and these two liquids are unlike.
   (c)   Attractions between hexane and water molecules are much weaker than attractions between water molecules or between hexane molecules.
   (d)   The covalent bonds in a water molecule are exceptionally strong.

SEE NEXT PAGE

7.   Which one of the following has a noble-gas electron configuration?

       (a) H^+
       (b)   H
       (c) Fe^{3+}
       (d) H^-

8.   In which of the following substances would you expect the bonding to be most ionic?

       (a)   Ice.
       (b)   Solid ammonia.
       (c)   Solid lead bromide.
       (d)   Solid silicon dioxide.

9.   Which of the following solids would you expect to find discrete molecules?

       (a)   Sulfur.
       (b)   Sodium cyanide.
       (c)   Aluminium.
       (d)   Graphite.

10.   Which of the following likely to be the formula of the most stable sulfide of gallium (Atomic Number 31)?

       (a) GaS_2
       (b) Ga_2S
       (c) Ga_2S_3
       (d) Ga_3S_2.

11.   In which one of the following compounds are **both** ionic **and** covalent bonding present?

       (a)   Ammonium chloride
       (b)   Hydrogen chloride
       (c)   Potassium chloride
       (d)   Trichloromethane (chloroform)

12.   The first eight successive ionization energies (in kJ mol^{-1}) for an element are:
              1.02   1.91   2.92   4.96   6.28   21.3   25.4   29.8

       What is the element?

       (a)   Na
       (b)   A1
       (c)   P
       (d)   Ar

13.   In which one of the following substances are dispersion forces the main intermolecular forces at room temperature?

       (a)   Chromium
       (b)   Potassium chloride
       (c)   Octane
       (d)   Water

SEE NEXT PAGE

14.   Consider the intermolecular forces in the following, and so predict which compound has the
       lowest boiling point (at 1.00atm)

       (a) NH_3 [ammonia]
       (b) PH_3 [phosphine]
       (c) AsH_3 [arsine]
       (d) SbH_3 [stibine]

15.   A pure substance is very soluble in water and also very soluble in octane. Which one of the
       following is it?

       (a)   Cyclohexane
       (b)   1-Propanol
       (c)   Sodium iodide
       (d)   Tetrachloromethane

16.   Which one of the following properties is characteristic of elements whose atoms have
       incompletely filled d-subshells?

       (a)   They have only one valency.
       (b)   Their salts are usually coloured.
       (c)   They have low electrical conductivity.
       (d)   They are covalent network solids.

17.   1g of a mixture of three solids in equal amounts is added to 100 mL water with stirring. The
       mixture dissolves completely to give a clear solution. Which one of the following is it?

       (a)   Aluminium nitrate, barium sulfate, and cobalt chloride
       (b)   Ammonium carbonate, calcium nitrate, and potassium chloride
       (c)   Ammonium sulfate, copper (II) chloride, and potassium nitrate
       (d)   Iron (III) nitrate, sodium hydroxide, and sodium nitrate

INFORMATION FOR QUESTIONS 18 AND 19
       The following two questions are about a step in the production of nickel at the Kwinana Nickel
       Refinery. The ore is originally treated with ammonia and oxygen, converting the nickel into
       tetraamminenickel ion. In the next step, considered here, this complex ion is treated with
       hydrogen gas and converted to nickel metal. The forward reaction is represented by the following
       equation.

$$Ni(NH_3)_4^{2+} + H_2 \rightarrow Ni + 2NH_4^+ + 2NH_3$$
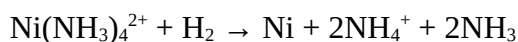
18   Which of the following sets of conditions will bring about the **highest yield** of nickel at
       equilibrium?

       (a)   High partial pressure of hydrogen and low partial pressure of ammonia
       (b)   High partial pressure of hydrogen and high partial pressure of ammonia
       (c)   Low partial pressure of hydrogen and low partial pressure of ammonia
       (d)   Low partial pressure of hydrogen and high partial pressure of ammonia

SEE NEXT PAGE

19.   Which of the following conditions will bring about the fastest rate of formation of nickel?

       (a)   High partial pressure of hydrogen
       (b)   Low partial pressure of hydrogen
       (c)   High partial pressure of ammonia
       (d)   None of the above, because although equilibrium is affected by gas pressure, rate of
              reaction is not.

20.   As ammonium chloride dissolves in water the temperature of the solution decreases. Which one
       of the following statements about the reaction is **false?**

       (a) ΔH for $NH_4Cl(s) \rightarrow NH_4^+(aq) + Cl^-(aq)$ is negative
       (b)   When the NH_4Cl dissolves, the conductivity of the solution increases
       (c) NH_4Cl dissolves more rapidly as the temperature is raised
       (d)   More energy is needed to separate the ions from each other than is released when water
              molecules surround the ions

21.   For the reaction represented by the potential energy diagram below, which one of
       the following statements is **true**?


Potential Energy

       (a)   The activation energy for the forward reaction is smaller than the enthalpy change
       (b)   The reaction mixture will get hot as the reaction proceeds
       (c)   The value of ΔH is negative.
       (d)   The activation energy for the forward reaction is greater than that for the reverse reaction.

22.   Which one of the following statements is true?

       (a)   The rates of all chemical reactions increase with temperature
       (b)   Exothermic reactions slow down when the reactants are heated
       (c)   Only endothermic reactions go faster when the reactants are heated
       (d)   Only exothermic reactions proceed spontaneously at room temperature

23.   In an experiment, 2 g of magnesium shavings dissolve in 500 mL of 2 mol L^{-1}
       hydrochloric acid with the production of considerable quantities of heat. Which one of the
       following actions will **NOT** increase the initial rate of production of hydrogen?

       (a)   Using the same mass of magnesium but using larger pieces of the metal
       (b)   Heating the reaction mixture
       (c)   Using 500 mL of 5 mol L^{-1} acid instead of 500 mL of 2 mol L^{-1} acid
       (d)   Stirring the reaction mixture

SEE NEXT PAGE

24.   A common experiment used in the laboratory to demonstrate chemical equilibrium involves the chromate/dichromate equilibrium. This can be represented by the equation:

$$2CrO_4^{2-}(aq) + 2H^+(aq) \qquad Cr_2O_7^{2-}(aq) + 2H_2O(1)$$

If 2 g of sodium dichromate is dissolved in 100 mL of distilled water, which one of the following actions will increase the concentration of chromate ion in the mixture?

(a)   Adding 2 mL of distilled water to the mixture
(b)   Adding 100 mL of distilled water to the mixture
(c)   Adding a solution of sodium hydroxide to the mixture
(d)   Adding dilute sulfuric acid to the mixture

25.   Which one of the following properties would **NOT** be exhibited by niobium (atomic number 41)?

(a)   It is an electrical insulator
(b)   Many of its compounds are coloured
(c)   It can exhibit various oxidation states in its salts
(d)   It can take part in the formation of complex ions

26.   Which one of the following statements about the following statements about the following reversible reaction is **TRUE**?

$$3H_2(g) + N_2(g)NH_3(g)$$

(Equilibrium constant = K.   Hear of reaction = ΔH)

(a)   K is constant under all conditions
(b)   A catalyst increases the yield of ammonia by increasing ΔH.
(c)   Ammonia is being formed when the gases are at equilibrium.
(d)   Increasing the pressure increases K.

27.   One step in the production of titanium metal from rutile (TiO_2) involves the following reaction at high temperature:

$$TiO_2(s) + 2 Cl_2(g) + 2 C(graphite) \rightarrow TiCl_4(g) + 2 CO(g)$$

For this reaction ΔH = -77 kJ mol^{-1}

Which of the following will increase the <u>rate</u> of reaction?
            I   Grinding the TiO_2 and C more intimately together
            II   Increasing the temperature
            III   Increasing the pressure

(a)   I only
(b)   I and II only
(c)   I and III only
(d)   All of I, II and III

28.   For the system $N_2(g) + 3 H_2(g)$ $2 NH_3(g)$
which one of the following statements about the equilibrium constant **K** is false.

(a)   At a constant pressure, K is constant over a range of temperatures.
(b)   The value of K at a constant temperature remains the same when a catalyst is added.
(c)   The smaller the value of K, the larger the value of $\frac{[N_2] [H_2]^3}{[NH_3]^2}$
(d)   A large value of K may not mean rapid production of ammonia

SEE NEXT PAGE

29.   The solubility of calcium chromate is 0.9 mol L^{-1} at 25^0C. Consider the equilibrium

$$CaCrO_4(s) \quad Ca^{2+}(aq) + CrO_4^{2-}(aq)$$
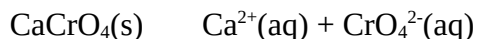
An equilibrium mixture is prepared consisting of a few yellow crystals of calcium chromate below a yellow solution.

What is observed when a little concentrated (5 mol L^{-1}) calcium chloride solution is added to the mixture.

(a)   More yellow crystals form, and the solution becomes paler
(b)   More yellow crystals form, and the solution becomes a darker yellow
(c)   The yellow crystals dissolve, and the solution becomes a darker yellow.
(d)   There is no significant change in appearance.

30.   Which of the following aqueous solutions is there the greatest number of ions?

(a)   1.00 L of 2.00 mol L^{-1} CH_3COONa solution.
(b)   1.00 L of 3.00 mol L^{-1} CH_3COOH solution.
(c)   1.00 L of 1.00 mol L^{-1} H_2SO_4 solution.
(d)   1.00 L of 2.00 mol L^{-1} Na_2CO_3 solution.

END OF PART 1

PART 2   **(70 marks = 35% of paper)**

Answer ALL questions in Part 2 in the spaces provided below. This part carries 70 marks (35% of the total)

_____

1.   Give balanced equations for any reactions which occur in the following experiments.

In each case describe what you would observe, including colour changes, precipitate formations (give the colour), or gas evolution (give the colour or describe as colourless). If reaction occurs but the change is not observable, you should state this.
Ions must appear in equations when appropriate.

(a)   Barium hydroxide solution is added to dilute hydrochloric acid.

Equation _____

Observation _____

_____

[3 marks]

(b)   Manganese dioxide pellets are added to hydrogen peroxide solution.

Equation _____

Observation _____

_____

[3 marks]

(c)   Lead nitrate solution is added to iron (II) sulfate solution.

Equation _____

Observation _____

_____

[3 marks]

(d)   Freshly precipitated copper (II) hydroxide is shaken with an excess of ammonia solution.

Equation _____

Observation _____

_____[3 marks]

SEE NEXT PAGE

2.   Identify by name or formula each of the following.

    (a) A halogen which is liquid at room temperature and pressure.

        _____

    (b) An ion which is orange in water solution and which is used as an oxidizing agent.

        _____

    (c)   A negatively-charged complex ion.

        _____

    (d)   A positive ion which is normally green in water solution.

        _____

    (e)   A compound which is a gas at room temperature and pressure and whose molecules have a
           dipole moment.

          _____

    (f)   A substance, other than water, which is a liquid at room temperature and pressure and
           which has hydrogen bonding between its molecules

        _____

                                                                                          [6 marks]

3.   The electron configuration of the lithium atom is $1s^2\ 2s^1$. Using the same notation, give the
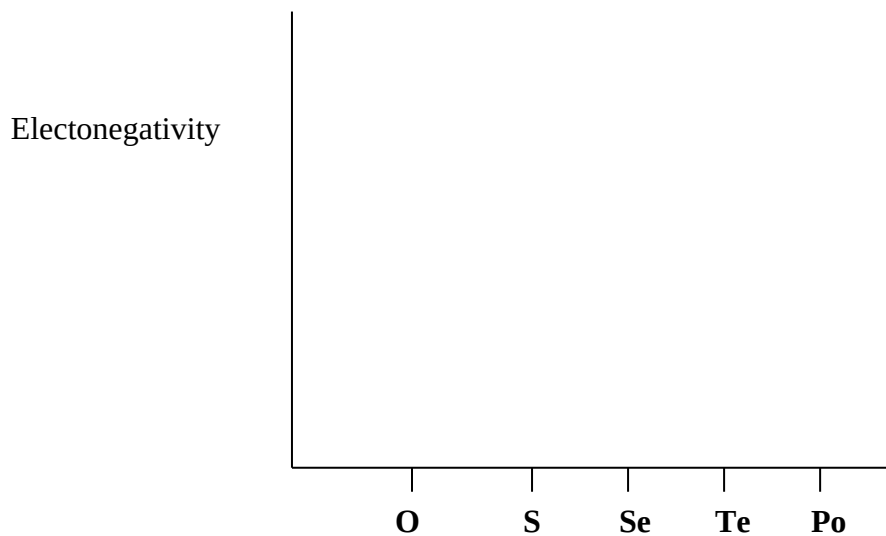   electron configuration of

    (a)   A magnesium atom _____

    (b)   A sulfide ion _____

                                                                                          [4 marks]

SEE NEXT PAGE

4.   Using the axes provided, draw sketch graphs of the following. You are not required to place any
        numbers on the scales

    (a)   The electronegatives of the elements of group VI.

Electonegativity

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    O       S       Se      Te      Po
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    (b)   The first six successive ionization energies of calcium.

Successive
Ionisation
Energy

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    1     2     3     4     5     6
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Number of ionisations
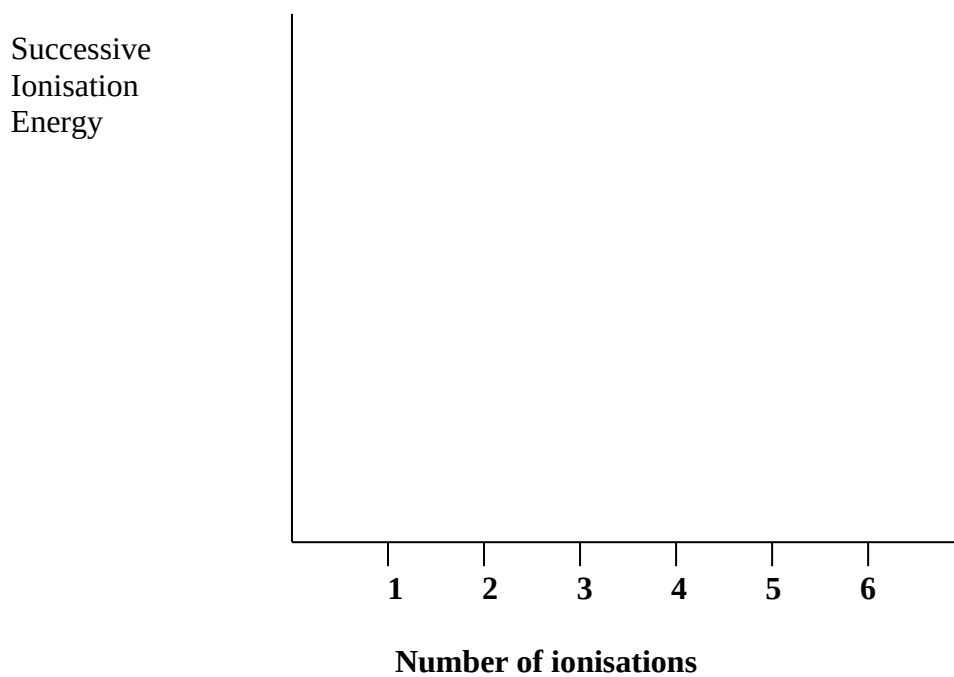
SEE NEXT PAGE

(c) The boiling points of the hydrides of group V elements.

Boiling Point

NH₃   PH₃   AsH₃   SbH₃
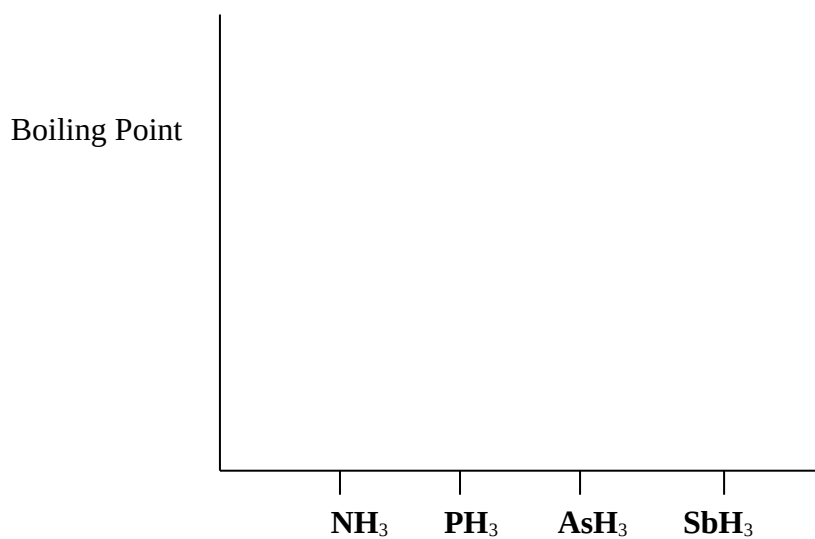
(d) The molecular polarity of chloro derivatives of methane as a function of the number of chlorine atoms in a molecule

Molecular
Polarity

0

0   1   2   3   4

Number of Chlorine atoms
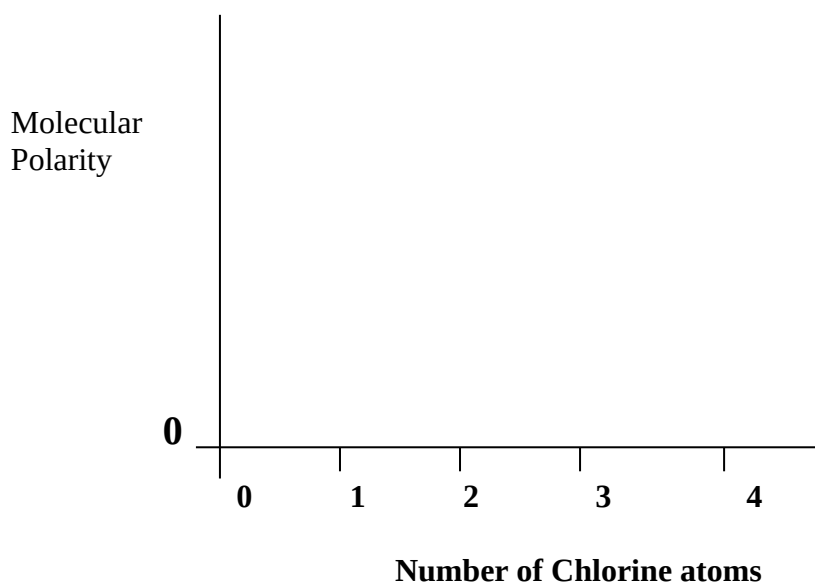
[8 marks]

SEE NEXT PAGE

5.   One step in the Contact Process for the manufacture of sulfuric acid involves the following reaction.

$$2SO_2(g) + O_2(g) \quad\quad 2SO_3(g) \quad\quad\quad \text{for which } \Delta H = -200kJ \text{ mol}^{-1}$$

This reaction is allowed to come to equilibrium at $450\,^0C$ and a pressure of 1.00 atm. In the table below describe the effect of the described changes in conditions on the equilibrium amount of sulfur trioxide. Write 'increase', 'decrease' or 'no difference', and give a brief reason for your answer.

Change in system	Effect of this change on amount of SO3; 'increase', 'decrease' or 'no difference'	Reason
The temperature is raised to $600\,^0C$, whilst the pressure is kept at 1.00atm.		
The pressure is raised to 10.0 atm by reducing the volume, whilst the temperature is kept at $450\,^0C$.		
V_2O_5 catalyst is added to the system, whilst the original temperature and pressure are maintained.		

[12 marks]

SEE NEXT PAGE

6.   For each molecule listed in the table below.

(i)   draw the structural formula/electron dot diagram
representing all valence shell electron pairs either as : or as –

[for example, water   H : O : H   or   H–O–H   or   H–O–H   and so on]

(ii)   indicate the shape of each molecule by either a sketch or a name.

(iii)   indicate the polarity of the molecule as polar or non polar

Molecule	Structural formula (showing all valence shell electrons)	Shape (sketch or name)	Polar/non polar
Hydrogen sulfide			
Aluminium fluoride			
Hydrogen carbonate ion			

[12 marks]

SEE NEXT PAGE

7.   The following six substances have their boiling points listed in the table below.

Acetic acid (ethanoic acid), CH_3COOH
Ethanol, CH_3CH_2OH
Hydrogen chloride, HCl
Hydrogen fluoride, HF
Methane, CH_4
Water, H_2O

Consider the intermolecular forces between the molecules and so estimate the relative boiling points of the substances. Hence complete the table by writing the formulae of the substances in the appropriate places.
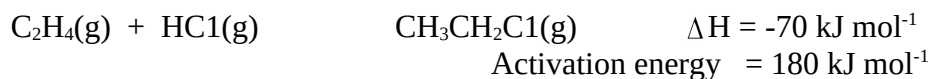
Formulae	Boiling point (^0C)
	-162
	-85
	19
	78
	100
	118

[6 marks]

SEE NEXT PAGE

8.   Ethylene (ethane) and hydrogen chloride react according to the equation

$C_2H_4(g) + HCl(g) \qquad CH_3CH_2Cl(g) \qquad \Delta H = -70$ kJ mol^{-1}

Activation energy $= 180$ kJ mol^{-1}

On the axes below, draw a labeled potential energy diagram for this reaction. Mark in your own choice of scale for potential energy.

Potential Energy

(kJ mol^{-1})
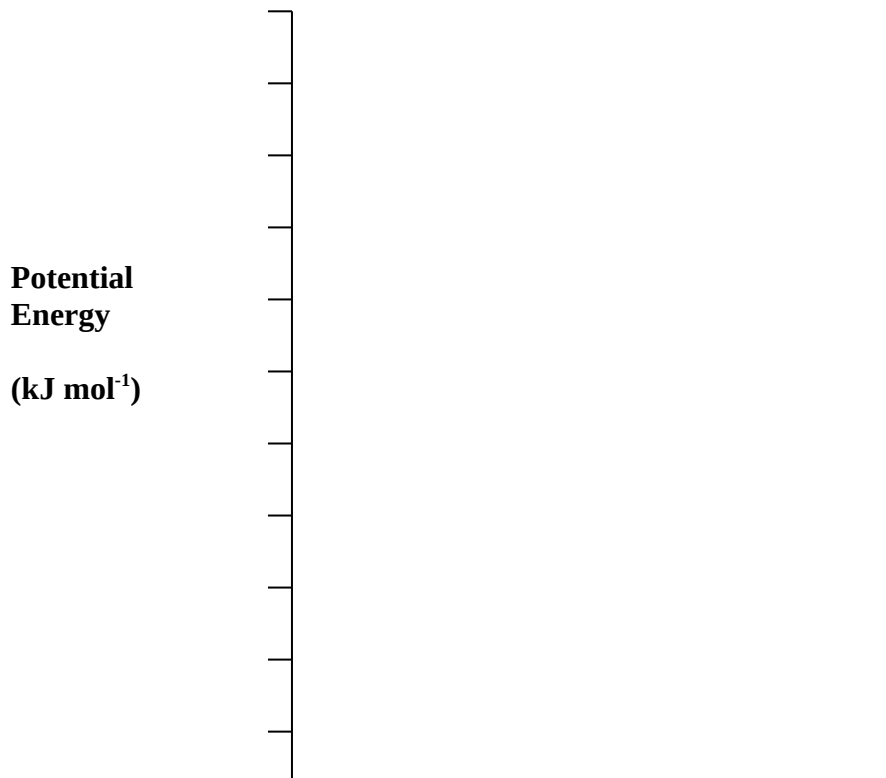
[4 marks]

9.   Carbon disulfide can be manufactured by the endothermic reaction of sulfur trioxide and carbon dioxide according to the equation:

$2SO_3(g) + CO_2(g) \qquad CS_2(g) + 4O_2(g)$

If this reaction is allowed to come to equilibrium at 100^{0}C and a pressure of 400 kPa, what would be the effect on the equilibrium amount of carbon disulfide of each of the following changes? (Write **"increase", "decrease" or "no change"**)

(a)   Raising the temperature to 200^{0}C whilst maintaining the pressure at 400 kPa.

        _____

(b)   Reducing the pressure to 200 kPa whilst maintaining the temperature at 100^{0}C.

        _____

(c)   Removing oxygen from the equilibrium mixture.

        _____

[6 marks]

END OF PART 2

PART 3

Answer ALL questions in Part 3. The calculations are to be set out in detail in this Question/Answer Booklet. Marks will be allocated for correct equations and clear setting out, even if you cannot complete the problem. When questions are divided into sections, working for each section must be clearly distinguished using a, b, etc. Final numerical answers MUST be corrected to three (3) significant figures where appropriate and units MUST be provided where applicable. Information, which may be necessary for solving the problems, is located on the Separate Chemical Data Sheet. Failure to show reasoning clearly will result in loss of marks. This part carries 50 marks (25% of the total).

1.   (a)   A pure compound, which is a colourless liquid at room temperature, boils at 138^0C, and analysis shows it to contain 90.49% carbon and 9.48% hydrogen by mass. Calculate the empirical formula of the compound.

[6 marks]

(b)   Explain why the empirical formula calculated in (a) cannot be its molecular formula?

[2 marks]

(d)   A known mass of the liquid is vaporised, and from the volume of gas produced the molecular weight of the compound is calculated to be about 105. What is the molecular formula of the compound

[2 marks]

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SEE NEXT PAGE

2. A pure substance `A' is a liquid boiling at 194^0C. 1.650g of 'A' is vaporized at 200^0C and 101.3 kPa, and the gas produced occupies 250 mL.

Calculate the molecular weight (relative molecular mass) of 'A'.

[6 marks]

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SEE NEXT PAGE

3. A sample of Perth tap water contains 12.13 mg L^{-1} of magnesium and 5.01 mg L^{-1} of calcium.

In order to soften 200.00 l of tap water, a scientist adds 50.00 g of sodium carbonate decahydrate ($Na_2CO_3 \cdot 10H_2O$) to precipitate the magnesium ion and the calcium ion.

Calculate whether sufficient sodium carbonate has been added, and determine the mass of additional sodium carbonate decahydrate that needs to be added or the mass that is in excess

[10 marks]

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SEE NEXT PAGE

4.   The yellow mineral mendipite is a pure compound which contains only lead, oxygen, and chlorine.

(a)   1.205 g of mendipite is heated strongly in a current of hydrogen gas which removes the oxygen and chlorine atoms from the compound, until constant weight is reached. The grey blob which remains consists of 1.034 g of lead metal.

Calculate the percentage of lead in mendipite.

[3 marks]

(b)   1.803 g of mendipite is boiled with concentrated nitric acid for 1 hour; the solution is then cooled and diluted, and dilute silver nitrate solution added until no further precipitate forms. The mixture is left to stand in the dark for 1 hour, and when it is filtered, and the precipitate washed and dried, 0.713 g of silver chloride is obtained.

Calculate the percentage of chlorine in mendipite.

[3 marks]

(c)   Calculate the empirical formula of mendipite.

[5 marks]

(d)   The crystal lattice of mendipite consists of monoatomic ions. Write the formula of these ions.

[3 marks]

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SEE NEXT PAGE

5.   The following equation describes the reaction between sulfur tetrafluoride and diiodine pentaoxide:

$$5\ SF_4(g)\quad +\quad 2I_2O_5(s)\qquad\qquad 4\ IF_5(l)\quad +\quad 5\ SO_2(g)$$

32.07g of I_2O_5 is shaken with 6.02 L of SF_4 at 760^0C and 120 kPa, and the reaction allowed to go to completion.

(a)   What volume of sulfur dioxide is produced at 760^0C and 120 kPa?

[5 marks]

  (b) What mass of each of the substances (reactants and products) is present at the completion of the reaction?

[5 marks]

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END OF PART 3

PART 4   (20 marks = 10% of paper)

Answer ONE of the following two extended answer questions. Where applicable use equations, diagrams and illustrate examples of the chemistry you are describing.

Marks are awarded for the relevant chemical content of your answer, and also for coherence and clarity of expression. Your answer should be presented in about 1 ½ – 2 pages. Write your essay on the lined sheets at the end of these questions.

1.   The following table gives information about the solubility of some solutes in the solvents water and hexane. The only unusual solute is allose whose structure is:
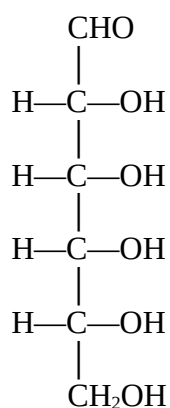
```
        CHO
         |
  H—C—OH
         |
  H—C—OH
         |
  H—C—OH                  allose (a crystalline sugar)
         |
  H—C—OH
         |
      CH₂OH
```

Solute	Solvent	
	Water	Hexane
decane	insoluble	soluble
methanol	soluble	slightly soluble
1-pentanol	slightly soluble	soluble
allose	soluble	insoluble
sodium chloride	soluble	insoluble
silver chloride	insoluble	insoluble

Discuss the intermolecular and interionic forces involved in the above solutes and solvents, and so account for whether each solute dissolves or not.

[Note that "like dissolves like" is a statement and not an explanation.]

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OR

2. An industrial method for the manufacture of nitric acid is the Ostwald Process, and the reactions involved are described as follows:

Stage	Description	Equation	ΔH (kJ)
1	NH_3 and O_2 are heated together at $800°C$ in the presence of a platinum catalyst.	$4\,NH_3(g)\ +\ 5\,O_2(g)\ \rightarrow\ 4\,NO(g)\ +\ 6\,H_2O(g)$	-908
2	O_2 is added to the NO from Stage 1.	$2\,NO(g)\ +\ O_2(g)\ \rightarrow\ 2\,NO_2(g)$	-114
3	The NO_2 from Stage 2 is bubbled through water.	$2\,NO_2(g)\ +\ H_2O(\ell)\ \rightarrow\ HNO_2(aq)\ +\ H+(aq)\ +\ NO_3^-(aq)$	-106
4	The HNO_2/HNO_3 mixture from Stage 3 is heated to produce concentrated nitric acid. (The NO is recycled into Stage 2.)	$3\,HNO_2(aq) \rightarrow H^+(aq)\ +\ NO_3^-(aq)\ +\ H_2O(\ell)\ +\ 2\,NO(g)$	+44

Each stage can be summarized by a reaction diagram showing initial state, transition state and final state. Sketch such a reaction diagram for each stage. Use your diagrams and your knowledge of rate and equilibrium principles to explain why the conditions have been chosen for each stage in the process.

END OF QUESTIONS