Chemistry 3AB

Semester Two Examination, 2011

Question/Answer Booklet

NAME: _____

TEACHER:

Marker use only

Part	Marks achieved	Marks available
1 Multiple choice	/50	50 (25%)
2 Short answer	/70	70 (35%)
3 Extended answers	/80	80 (40%)
TOTAL		200 (100%)

_____

%

Time allowed for this paper
Reading time before commencing work: Ten minutes
Working time for paper: Three hours

Materials required/recommended for this paper

To be provided by the supervisor
This Question/Answer Booklet
Separate Multiple Choice Answer Sheet
Separate Chemistry Data Sheet

SEE NEXT PAGE

To be provided by the candidate
Standard Items: Pens, pencils, eraser or correction fluid and ruler
Special Items: A 2B, B or HB pencil for the separate Multiple Choice Answer Sheet and calculators satisfying the conditions set by the Curriculum Council for this subject.

Important note to candidates
No other items may be taken into the examination room. 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.

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Structure of this paper

Part	Number of questions available	Number of questions to be attempted	Suggested working time (minutes)	Marks available
1 Multiple choice	25	ALL	50	50 (25%)
2 Short answer	11	ALL	60	70 (35%)
3 Extended answers	7	ALL	70	80 (40%)
			Total marks	200 (100%)

Instructions to candidates

Answer the questions according to the following instructions:

Part 1: Answer **all** questions, using a 2B, B or HB pencil on the separate Multiple Choice Answer Sheet. **Do not** use a ballpoint or ink pen.

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 on the Multiple Choice Section do this.

Parts 2 and 3 Write your answers in the spaces provided in this Question/Answer Booklet. A blue or black ball point or ink pen should be used.

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.

The examiners recommend that you spend your reading time mainly reading the Instructions to Candidates and Parts 2 and 3.

At the end of the examination make sure that your name is on your Question/Answer Booklet and on your separate Multiple Choice Answer Sheet.

Chemical Equations
For full marks, chemical equations should refer only to those specific species consumed in the reaction and the new species produced. These species may be **ions** [for example $Ag^{+}_{(aq)}$], **molecules** [for example $NH_{3(g)}$, $CH_3COOH_{(l)}$, $CH_3COOH_{(aq)}$] or **solids** [for example $BaSO_{4(s)}$, $Cu_{(s)}$, $Na_2CO_{3(s)}$].

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PART 1 (50 marks = 25% of paper)

This section has 25 questions. Answer **ALL** questions on the separate Multiple Choice Answer Sheet provided. For each question shade the box to indicate your answer. Marks will not be deducted for incorrect answers. Each question in this part is worth 2 marks.

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1. Which of the following elements has the highest **second** ionisation energy?

   (a) Calcium
   (b) Magnesium
   (c) Potassium
   (d) Sodium

2. An element, E, is able to react to form **both** ionic and covalent compounds. How many valence electrons would its atoms most likely possess?

   (a) 1
   (b) 2
   (c) 7
   (d) 8

3. In which of the following pairs of atomic species is the first species larger in diameter than the second species?

   (a) sodium ion sodium atom
   (b) oxide ion sulfide ion
   (c) calcium atom magnesium ion
   (d) potassium ion potassium atom

4. Three of the following species have the same number of protons. Which has the **different** number of protons?

   (a) carbonium ion CH_3^+
   (b) neon ion Ne^+
   (c) fluoride ion F^-
   (d) amide ion NH_2^-

SEE NEXT PAGE

5. Which of the following statements about graphite and silicon dioxide is **true**?

   (a) Both have atoms bonded together by sharing electrons.

   (b) Both have delocalised electrons.

   (c) Graphite has a very high melting point while silicon dioxide has a very low melting point.

   (d) Silicon dioxide is ionic while graphite is metallic.

6. What is the shape of a water molecule?

   (a) Linear

   (b) Bent (V–shape)

   (c) Pyramidal

   (d) Tetrahedral

7. Which type of bonding/intermolecular force is **not** present in solid hydrogen chloride?

   (a) covalent

   (b) dipole – dipole

   (c) dispersion force

   (d) hydrogen bonding

8. The boiling points of a family of trihalomethanes (CHX_3) are listed below.

trifluoromethane	CHF_3	–84 ^oC
trichloromethane	$CHCl_3$	62 ^oC
tribromomethane	$CHBr_3$	150 ^oC
triiodomethane	CHI_3	330 ^oC

   The increase in boiling points moving down the list is due to an increase in the strength of:

   (a) covalent bonding.

   (b) dispersion forces.

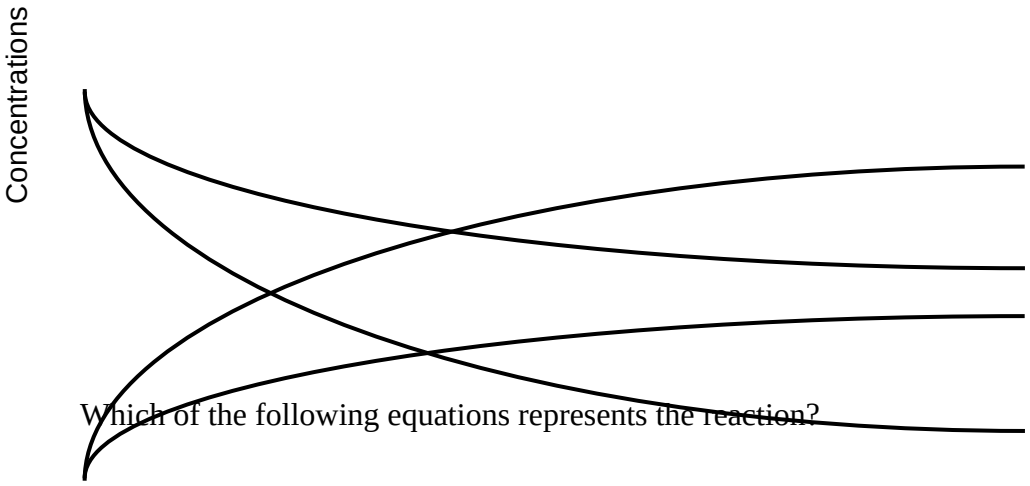
   (c) dipole-dipole.

   (d) hydrogen bonding.

9. Which of the following saturated solutions has the highest concentration of ions?

(a)	barium hydroxide	$Ba(OH)_2$
(b)	calcium phosphate	$Ca_3(PO_4)_2$
(c)	silver sulfate	Ag_2SO_4
(d)	zinc carbonate	$ZnCO_3$

10. Two gases are mixed in a **sealed flask**. They react to produce two new gases. The reaction is reversible and after some time equilibrium is reached. The following graph shows the concentrations of the four gases as equilibrium is established.



Which of the following equations represents the reaction?

(a) $Cl_2O_{7\,(g)} + 2\,CO_{(g)} \rightleftharpoons Cl_2O_{5\,(g)} + 2\,CO_{2\,(g)}$

(b) $N_2O_{5\,(g)} + SO_{2\,(g)} \rightleftharpoons N_2O_{4\,(g)} + SO_{3\,(g)}$

(c) $N_2O_{(g)} + 2\,ClO_{2\,(g)} \rightleftharpoons N_2O_{5\,(g)} + Cl_{2\,(g)}$

(d) $2\,PH_{3\,(g)} + 3\,COF_{2\,(g)} \rightleftharpoons 2\,PF_{3\,(g)} + 3\,CH_2O_{(g)}$

11. Molybdenum (III) chloride, $MoCl_3$, is a yellow solid. When dissolved in water the molybdenum ions react reversibly with chloride ions to form hexachloromolybdenum (III) ions, which are blue.

$$Mo^{3+}\,(aq) + 6\,Cl^{-}\,(aq) \rightleftharpoons [MoCl_6]^{3-}\,(aq) + 33\ kJ$$

(yellow) *(blue)*

As a result of the equilibrium the solution appears green. Which of the following procedures will cause the green solution to turn **blue**?

I. Bubbling hydrogen chloride gas through the solution

II. Adding a solution of silver nitrate

III. Heating the solution

IV. Adding a suitable catalyst to increase the forward reaction rate

(a) I only

(b) I and IV only

(c) II and III only

(d) II, III and IV only

12. Arsenine (AsH_3) can be produced by the hydrogen reduction of tetraarsenic hexoxide. The reaction is exothermic and reversible.

$$3\,As_4O_6\,(s) + 36\,H_2\,(g) \rightleftharpoons 12\,AsH_3\,(g) + 18\,H_2O\,(g) + 125\ kJ$$

Which of the following conditions will maximise the rate of forward reaction?

I. Continuously adding hydrogen at high pressure

II. Maintaining a high temperature

III. Continuously cooling the mixture

IV. Continuously removing the arsenine

(a) I and II

(b) II and III

(c) I and III

(d) I, III and IV

13. Which of the following ions does **not** have a conjugate base?

(a) CH_3COO^-

(b) HCO_3^-

(c) NH_4^+

(d) H_3O^+

14. Water can act as an acid or as a base. In which of the following reactions is water acting as an **acid**?

I. $H_2O + NH_4^+ \rightarrow H_3O^+ + NH_3$

II. $H_2O + HPO_4^{2-} \rightarrow OH^- + H_2PO_4^-$

III. $H_2O + SO_4^{2-} \rightarrow OH^- + HSO_4^-$

IV. $H_2O + HCl \rightarrow H_3O^+ + Cl^-$

(a) I only

(b) I and IV only

(c) II and III only

(d) IV only

15. Three of the following solutions have a pH of very close to 7. One has a pH of close to 4. Which is the pH 4 solution?

(a) ammonium acetate NH_4CH_3COO

(b) ammonium chloride NH_4Cl

(c) ammonium phosphate $(NH_4)_3PO_4$

(d) sodium bromide $NaBr$

16. In which of the following species does platinum have the **lowest** oxidation number?

(a) H_2PtCl_6

(b) $NaPtCl_4$

(c) Pt_2O_3

(d) $PtCr_2O_7$

17. Which of the following metals can be produced by bubbling hydrogen gas through a solution of its chloride?

    (a) Copper
    (b) Iron
    (c) Sodium
    (d) Zinc

18. A group of students is designing an electrochemical cell consisting of two half cells joined by a salt bridge. Each of the half cells consists of a metal rod placed in a 1 mol L^{-1} solution of its nitrate. Which of the following pairs of half cells will produce the highest voltage (emf)?

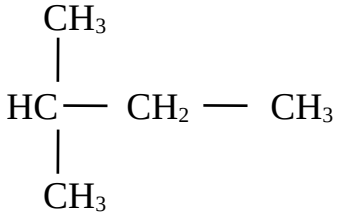
    (a) Aluminium in aluminium nitrate solution and iron in iron (II) nitrate solution
    (b) Copper in copper (II) nitrate solution and zinc in zinc nitrate solution
    (c) Lead in lead (II) nitrate solution and manganese in manganese (II) nitrate solution
    (d) Silver in silver nitrate solution and tin in tin (II) nitrate solution

19. Which of the following will oxidise **quickly** in moist air if its surface is scratched, but further oxidation is prevented by the oxide layer that has formed on the surface?

    (a) A sheet of aluminium
    (b) A sheet of galvanised iron (completely coated with a thin layer of zinc)
    (c) A sheet of copper
    (d) A 'tin' can (iron coated completely with a thin layer of tin)

20. The following structural diagram represents a saturated hydrocarbon. What is the correct (IUPAC) name for the hydrocarbon?

    (a) Dimethyl propane
    (b) Ethyl propane
    (c) Methyl butane
    (d) Pentane



21. Which of the following chlorinated propenes has **two** geometric (cis-trans) forms?

    I. 1 – chloropropene
    II. 2 – chloropropene
    III. 3 – chloropropene

    (a) I only
    (b) I and III only
    (c) II and III only
    (d) III only

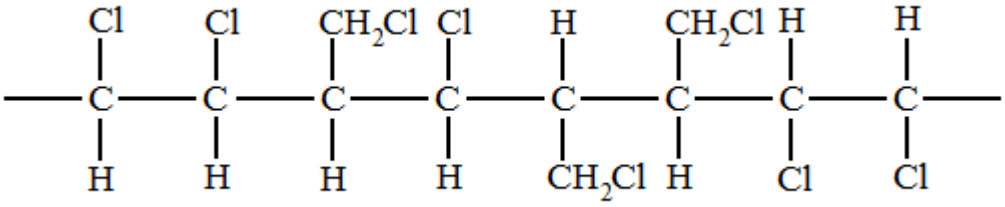
22. Which of the following substances is **least likely** to react with an acidified solution of sodium permanganate?

    (a) 1 – propanol
    (b) 2 – propanol
    (c) Propanal
    (d) Propanone

23. One mole of an organic compound, containing only carbon, hydrogen and oxygen, required five moles of oxygen for complete combustion. Four moles of carbon dioxide and four moles of water were produced. What was the formula of the compound?

    (a) C_2H_4O
    (b) $C_4H_4O_2$
    (c) C_4H_8O
    (d) $C_4H_8O_2$

24. The following diagram represents part of a polymer chain in a plastic.



This polymer could be produced from

I. cis – 1,3 – dichloropropene
II. trans – 1,3 – dichloropropene
III. dichloropropane
IV. 1,2 - dichloropropene

(a) I or II only
(b) II or IV only
(c) II or IV only
(d) I, II or IV only

25. Which of the following substances will **not** act as a surfactant (soap / detergent)?

(a) Ammonium stearate (stearate ion = $C_{17}H_{35}COO^-$)
(b) Magnesium stearate (stearate ion = $C_{17}H_{35}COO^-$)
(c) Hexadecylammonium sulfate (hexadecylammonium ion = $C_{16}H_{33}NH_3^+$)
(d) Sodium hexadecylsulfonate (hexadecylsulfonate ion = $C_{16}H_{33}SO_3^-$)

END OF PART 1

PART 2 (70 marks = 35% of paper)

This section contains 12 questions. Answer **ALL** questions in the spaces provided.

Spare pages are included at the end of this booklet. They can be used for planning your answers and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use a spare page to continue an answer, indicate in the original answer space where the answer is continued, i.e. state the page number. Write the number of the question(s) that you are continuing to answer at the top of the page.

Suggested working time: 60 minutes

Question 26 **(4 marks)**

Write equations for the reactions that occur in each of the following procedures.
If no reaction occurs, write 'no reaction'. 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^+], **molecules** [for example NH_3] or **solids** [example $CaCO_3$].

(a) Chlorine gas is bubbled through an acidified solution of hydrogen peroxide.

(2 marks)

Equation

_____

_____

_____

(b) Copper wire is added to concentrated nitric acid

(2 marks)

Equation

_____

_____

_____

Question 27 **(4 marks)**

Write observations for any reactions that occur in the following procedures. In each case describe in full what you would observe, including any

- colours
- precipitates
- gases produced

If no change is observed, you should state this.

(a) Hydrogen peroxide is added to an acidified solution of iron (II) sulfate.

(2 marks)

Observation

_____

_____

_____

_____

(b) Copper wire is placed in a solution of nickel chloride

(2 marks)

Observation

_____

_____

_____

_____

Question 28 **(4 marks)**

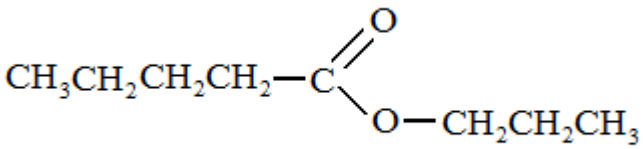
Anions such as hydrogencarbonate (HCO_3^-) and hydrogenphosphate (HPO_4^{2-}) are able to act as bases in aqueous solutions. However, in water, hydrogensulfate ion (HSO_4^-) does not act as a base.

Explain these facts. Include equations in your answer.

(4 marks)

Question 29 **(4 marks)**

Write the IUPAC name, or draw a structural formula, for the following organic compounds.

A secondary alcohol	(1 mark)
(1 mark)	$CH_3CH(CH_3)COCH_3$
cis – 2 – pentene	(1 mark)
(1 mark)	

Question 30 **(8 marks)**

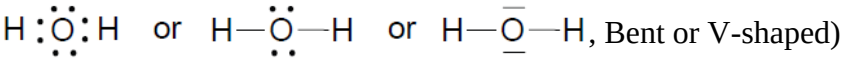
In the table, draw the structural diagram of **all** isomeric alcohols of molecular formula $C_4H_{10}O$. Name each alcohol, and identify each as primary (1°), secondary (2°) or tertiary (3°). You may not need all the rows in the table.

(8 marks)

Structure	Name	1°, 2°, or 3°

Question 31 **(5 marks)**

For each species in the following table, draw the structural diagram, representing all valence shell electron pairs as dots (**:**) or as dashes (**—**), and indicate the shape (name or sketch) of the species.

(for example, water  Bent or V-shaped)

Species	**Structural diagram** (showing all valence shell electron pairs)	**Shape** (name or sketch)
Methylidyne phosphane HCP	(1 mark)	(1 mark)
Sulfite ion SO_3^{2-}	(2 mark)	(1 mark)

Question 32 **(6 marks)**

Dodecane can be catalytically cracked to produce lower molecular weight hydrocarbons.

$$C_{12}H_{26}\,(g) + 725\ kJ \rightleftharpoons C_8H_{18}\,(g) + C_4H_8\,(g)$$

In a laboratory experiment a reaction vessel, whose volume can be changed, contains an equilibrium mixture of all three gases, and 40% of the mixture is dodecane.

Complete the table by predicting and explaining the effect on the position of equilibrium of the following imposed changes. (Simply stating Le Chateliers principle does not constitute an explanation)

Imposed change	**Effect on equilibrium position To right, to left or no change**	**Explanation**
(a) The volume is decreased keeping the temperature constant.	(1 mark)	(1 mark)
(b) The temperature is increased keeping the volume constant.	(1 mark)	(1 mark)
(c) Some C_4H_8 (g) is removed from the vessel.	(1 mark)	(1 mark)

Question 33 **(9 marks)**

Phosphoric acid (H_3PO_4) is a polyprotic acid.

(a) List all the **anions** present (in order of decreasing concentration) in a solution of phosphoric acid (excluding hydroxide). Write equations to show how you determined this.

(3 marks)

Of these ions, which is the most basic?

(1 marks)

(c) Phosphoric acid is a weak acid. However, it becomes stronger when heated. Explain why.

(3 marks)

(c) Despite having several hydrogen atoms, propanoic acid (CH_3CH_2COOH) is not a polyprotic acid. Explain why

(2 marks)

_____

_____

_____

_____

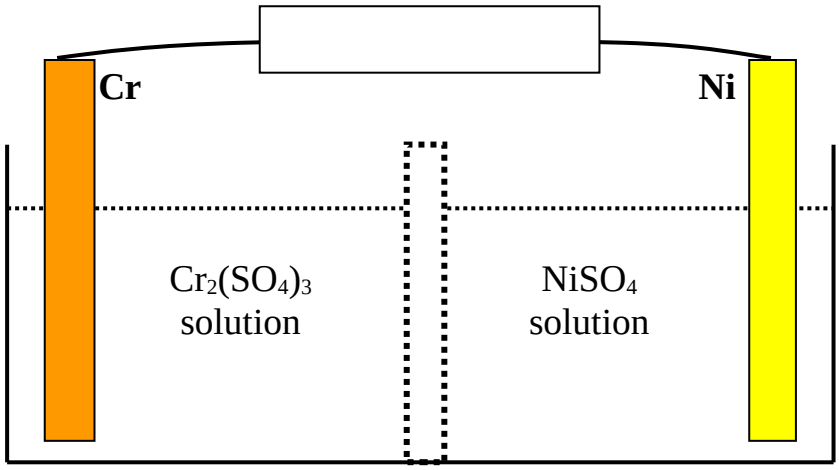
_____

_____

_____

Question 34 **(11 marks)**

The following diagram represents an electrochemical cell based on chromium and nickel. A porous barrier separates the two half cells but allows ions to migrate between them.



(a) Write the half cell equations and the overall balanced reaction that occurs.

(3 marks)

_____

_____

_____

(b) On the diagram, label the electrode that is the anode and the cathode.

(1 mark)

(c) Draw an arrow in the box provided to show the direction of the **electron flow** in the wire.

(1 mark)

(d) What emf (voltage) will be generated? (Assume 1 mol L^{-1} concentrations.)

(1 mark)

_____

(e) Which metal cation will migrate through the porous barrier?

(1 mark)

_____

(f) List TWO changes that will be observed.

(2 marks)

_____

_____

_____

_____

_____

(g) What will be observed if the porous barrier is removed and the solutions become mixed?

(2 marks)

_____

_____

_____

_____

_____

Question 35 **(8 marks)**

The inside surface of copper frying pans used for cooking foods such as eggs can develop a black coating due to the formation of copper (II) sulfide. These blackened pans can be restored by adding an electrolytic solution such as sodium chloride and placing aluminium foil in the pan. The aluminium foil is held down so that it makes good contact with the copper surface. This method does not remove any of the copper from the pan. The two half reactions that occur are:

$$CuS\ (s) + 2\ e^- \rightarrow Cu + S^{2-}$$

$$Al\ (s) \rightarrow Al^{3+} + 3\ e^-$$

The by-product of this process is aluminium sulfide.

(a) Write an equation for the net redox reaction.

(2 marks)

(b) Why must the aluminium foil be touching the copper surface?

(2 marks)

(d) A frying pan has a 0.0525 g coating of copper sulfide. What mass of aluminium sulfide will be formed as the copper is restored?

(4 marks)

SEE NEXT PAGE

Question 36 **(7 marks)**

Explain each of the following facts about reactions between acids and metals. Include equations.

(a) Zinc reacts with hydrochloric acid, but copper does not.

(4 marks)

(b) Copper reacts with nitric acid and a gas is produced. The gas is not hydrogen.

(3 marks)

END OF PART 2

SEE NEXT PAGE

PART 3 (80 marks = 40% of paper)

This section contains 6 questions. You must answer **ALL** questions. Write your answers in the spaces provided.

Where questions require an explanation and/or description, marks are awarded for the relevant chemical content and also for coherence and clarity of expression. Lists or dot points are unlikely to gain full marks.

Final answers to calculations should be expressed to three (3) significant figures, and provide units where applicable. Information which may be necessary for solving the problems is located on the separate Chemistry Data Sheet.

Spare pages are included at the end of this booklet. They can be used for planning your answers and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use a spare page to continue an answer, indicate in the original answer space where the answer is continued, i.e. state the page number. Write the number of the question(s) that you are continuing to answer at the top of the page.

Suggested working time: 70 minutes

Question 37 **(10 marks)**

A swimming pool holds 250 cubic metres of water. The owner tests the water and finds its hydroxide ion concentration, $[OH^-]$, is 5.55×10^{-5} mol L^{-1}.
Note: Assume temperature of 25 °C and that (1 cubic metre = 1000 L)

(a) What is the pH of the pool water?

(4 marks)

(b) Thinking the pH is too low, the owner adds to the water 3.00 kg of caustic soda (NaOH). The water pump ensures that the caustic soda dissolves and becomes evenly mixed in the pool.

What is the new pH of the water?

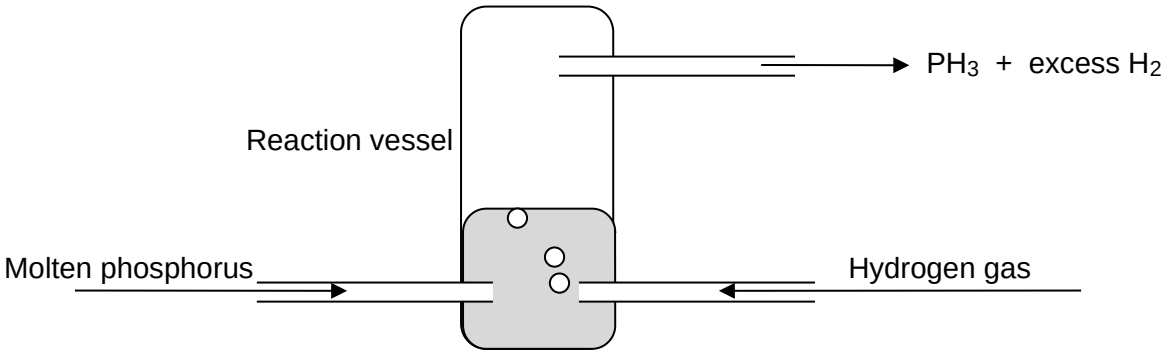
(6 marks)

Question 38 **(15 marks)**

Phosphine (PH_3) is a gas that could be produced by bubbling hydrogen gas through molten phosphorus.

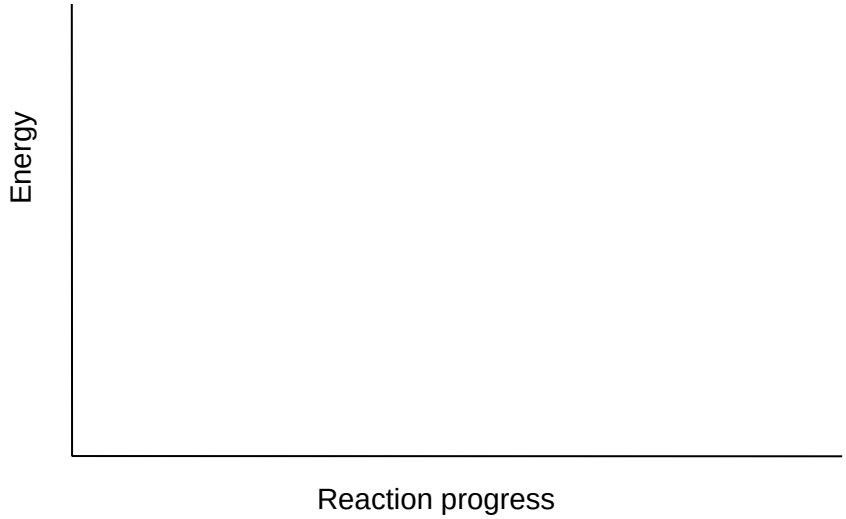
The reaction is reversible $P_4\,(l) + 6\,H_2\,(g) \rightleftharpoons 4\,PH_3\,(g) + 33\text{ kJ}$

Activation energy = 66 kJ



(a) Draw a labelled energy profile graph to represent the process.
Indicate clearly the reactants, products, activation energy and enthalpy change.

(4 marks)



(b) Would a high temperature, or a low temperature, be used in the process? Consider the reaction rate and the product yield in your answer.

(3 marks)

(c) Would a high pressure, or a low pressure, be used in the process? Consider the reaction rate and the product yield in your answer.

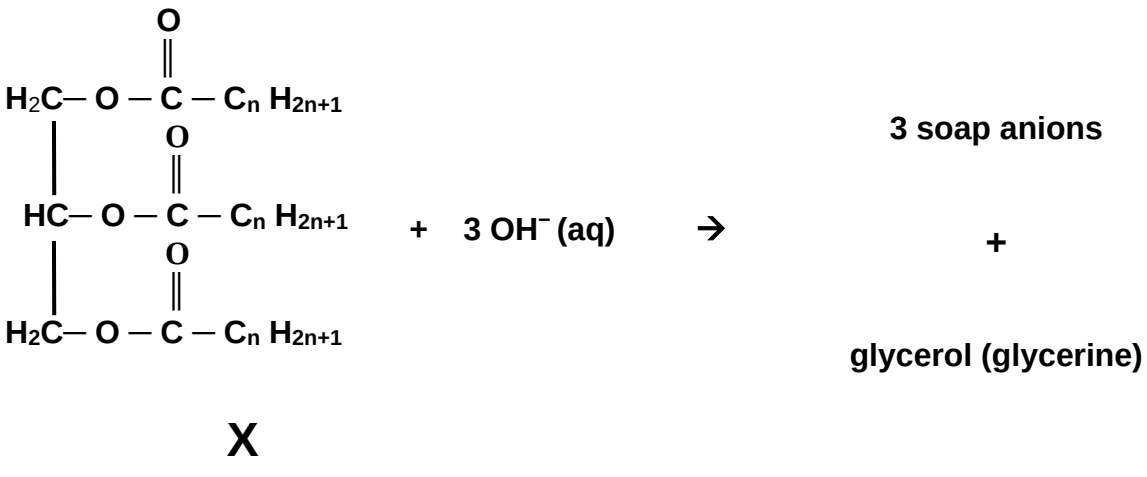
(3 marks)

(d) If the process is only 70.0% efficient what mass of phosphorus would be needed to produce 4500 kL of phosphine (stored at 3.55 atmospheres pressure in cylinders at 30.0 ^{o}C)?

(5 marks)

Question 39 **(11 marks)**

Soap can be produced by the alkaline hydrolysis of animal fat. The structure of the fat can be represented by the formula, **X**, below. The number n is large, usually about 16. The equation represents the hydrolysis reaction. Soap is simply the sodium salt of the anion.



X

(a) What is another name for this process of producing soap?

(1 mark)

_____

(b) What is the general name for compounds represented by the letter **X**?

(1 mark)

_____

(c) Write a formula for soap, substituting numbers for the letter n.

(1 mark)

_____

(d) Why does the hydrocarbon chain (C_nH_{2n+1}) have to be long? Include a diagram.

(4 mark)

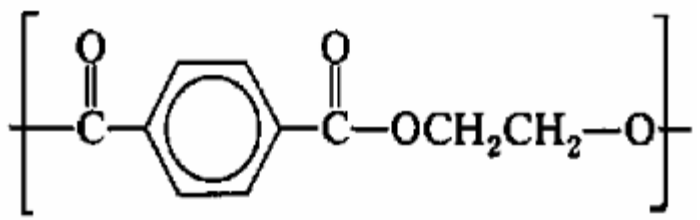
(e) When n = 16 in the formula C_nH_{2n+1} the molecular molar mass of the fat is 848.54 g/mol. What mass of sodium hydroxide is needed to convert 1 tonne of fat into soap? [1 tonne = 1000 kg]

(4 mark)

SEE NEXT PAGE

Question 40 **(7 marks)**

The structural formula for the repeating unit of the polyester Dacron is shown below:



Dacron (also known as terylene or PET) is produced by condensation polymerisation. It is a thermoplastic and a good barrier material (moderately resistant).

(a) Draw the monomers used in the production of this polymer

(2 marks)

(b) Why is this reaction called condensation polymerisation?

_____

_____

(1 mark)

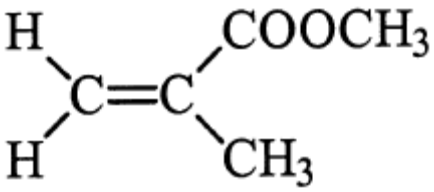
(c) Why is this polymer called a "polyester"?

_____

_____

(1 mark)

(d) Given the monomer below, draw a portion of the polymer that would be produced from it (your polymer should contain a minimum of three monomer units).



(2 marks)

(e) What type of polymerisation reaction formed this polymer?

(1 mark)

Question 41 **(14 marks)**

An organic compound containing only **carbon, hydrogen, oxygen and nitrogen** is analysed by the following steps:

- 1.473 g is burned in oxygen, converting the carbon to 2.515 g of carbon dioxide and the hydrogen to 1.158 g of water.
- Another 1.473 g is treated so that the nitrogen is oxidized to 0.6573 g of nitrogen dioxide (NO_2).
- When vaporized 1.473 g of the compound occupies 116 mL at 204 kPa pressure and 127 ^oC.

(a) What is the empirical formula of the compound?

(10 marks)

(b) What is its molecular formula?

(4 marks)

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Question 42 **(13 marks)**

A student wanting to produce ethyl oxalate prepares a mixture of 50.0 g of oxalic acid (HOOCCOOH) and 50.0 g of alcohol (CH_3CH_2OH) in a boiling flask. She adds a few drops of concentrated sulfuric acid and boils the mixture for about an hour.

The equation for the reaction is

$$HOOCCOOH + 2\ CH_3CH_2OH \rightarrow CH_3CH_2OOCCOOCH_2CH_3 + 2\ H_2O$$

(a) What is the function of the sulfuric acid?

(1 marks)

(b) Determine the limiting reactant.

(4 marks)

(c) What is the expected mass of ethyl oxalate that would be produced?

(4 marks)

(d) After the mixture has cooled she adds 100 mL of water. Soon she observes that there are two layers of liquid in the flask

(i) Suggest a reason for adding water.

(2 marks)

(ii) Why were there two liquid layers?

(2 marks)

Question 43 **(10 marks)**

A jar containing a pale pink powder is labelled *commercial grade manganese (II) sulfate* $MnSO_4$. A chemist needs to know its percentage by mass purity. He decides to analyse it by utilizing the reaction between hydrogen peroxide and manganese ion. The manganese ions are converted into a black precipitate of manganese (III) oxide. The black oxide quickly settles to the bottom of the conical flask. The equation for the reaction is

$$H_2O_2 + 2\,Mn^{2+} + H_2O \rightarrow Mn_2O_3 + 4\,H^+$$

The end point is taken to be when the final drop of hydrogen peroxide no longer produced a black precipitate.

The chemist dissolved 2.000 g sample of the impure manganese (II) sulfate in water in a 100 mL volumetric flask. He then pipetted 25.00 mL of this solution and diluted it to 250 mL in another volumetric flask.

Next, he titrated 20.00 mL aliquots of the diluted manganese (II) sulfate solution against 0.002211 mol L^{-1} hydrogen peroxide solution. The average titre required was 46.55 mL.

(a) How many moles of hydrogen peroxide were consumed in an average titration? (2 marks)

_____

_____

_____

_____

_____

(b) How many moles of manganese (II) ions were oxidised in an average titration? (2 marks)

_____

_____

_____

_____

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(c) How many moles of manganese (II) sulfate were present in the impure sample?
(3 marks)

(d) What was the percentage purity of the commercial manganese (II) sulfate?
(3 marks)

End of paper

Spare pages for working out or for continuing answers to previous questions

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