CONFIDENTIAL*

NAME..... CLASS.....

962/2
2006
TRIAL EXAMINATIONS
UPPER 6
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CHEMISTRY
PAPER 2

(2 ½ hours)

Answer all the questions in Section A in the spaces provided. All working must be shown. For numerical answers, units must be quoted wherever they are appropriate.

Answer any **four** questions from Section B. For this section, write your answers on your own examination sheets. Begin each answer on a fresh sheet of paper, and arrange your answers in numerical order. Tie your answer sheet to this booklet.

Answers may be written in either Malay or English.

A Data Booklet can be used.

For examiner's use	
1	
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Total	

Section A

Answer **all** questions in this section.

1. (a) When a container was connected to a manometer, it was observed that the pressure of the gas in the container was 5.24 kPa at the temperature 28.0^0C.
[Volume of manometer : 1.00×10^{-3} m^3]

(i) Assuming that the vapour of X behaves ideally, calculate the number of moles of X in the container.

(ii) Given that the mass of the gas is 0.27g. Determine the relative molecular mass of X

(iii) Calculate the number of molecules of X in the container.

[6 marks]

(b) (i) Sketch the energy level diagram for of an atom with the principal quantum number of n = 1 to n = 3

(ii) Using arrows to represents electrons, show on the diagram sketched above the electronic configurations of oxygen.

(iii)Explain why oxygen forms negative ions but not positive ions in simple compounds?

[4marks]

2. (a) Complete the table below

Ions	Ca^{2+}	Mn^{2+}	Ni^{2+}
Number of electrons in 3d shells in ions			

(i) Define, in terms of an element M, what is meant by the third ionisation energy.

(ii) Why is the third ionisation energy of calcium so much higher than those of the other elements?

[5 marks]

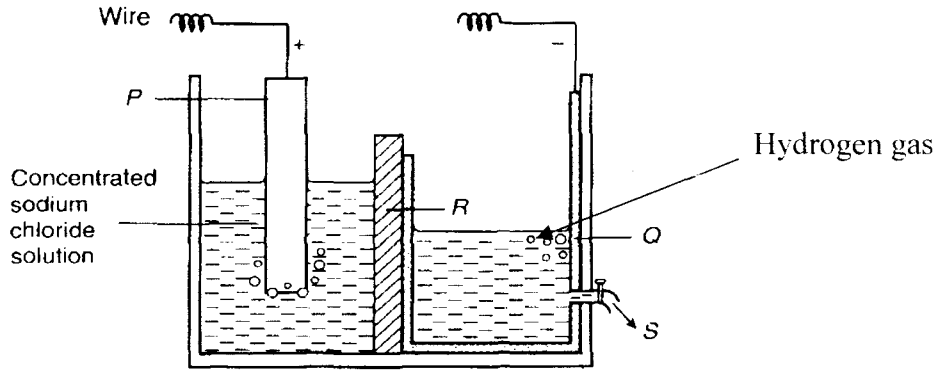
(b) (i) The relative molecular mass of ethane is 30 ,and that of sodium hydride is 24. Why is ethane a gas, whereas sodium hydride is a solid.

(ii) Draw the Lewis structure and state the shape of the molecule/ion in the table below

Molecule/ion	Lewis structure	Shape of molecule
BF_3		
NH_4^+		
SF_6		

[5marks]

3



(a) The figure above shows the Chlor-alkali cell used to manufacture chlorine.

(i) Write balanced equations for the reactions occuring at electrode P and Q.

P : _____

Q : _____

(ii) Why is the electrolyte at the left compartment placed higher than the right compartment?

_____

_____

(iii)S represents the flow of sodium hydroxide. Explain what will happen if the chlorine gas is allowed to react with sodium hydroxide.

_____

_____

[5 marks]

(b) CH_2Cl_2 has only one structural isomer whereas $PtCl_2(H_2O)_2$ has two isomers.

(i) Explain why this is so.

_____

_____

(ii) Give the IUPAC name for $PtCl_2(H_2O)_2$

(iii) Draw the isomeric structures that $PtCl_2(H_2O)_2$ exhibit.

[5 marks]

4. (a) Compound P undergoes the following reactions:

$$P \xrightarrow{\text{Bromine in trichloroethane}} CH_3CHBrCHBrCH_3 \xrightarrow{//} CH_2 = CHCH = CH_2$$

(i) Draw all possible structures for P and name them.

(ii) What type of reaction is step II?

_____

[5 marks]

(b) Chloroethene is the monomer from which the polymer PVC is produced. Chloroethene can be obtained from ethane in the laboratory by the following route:

$CH_2 = CH_2 \xrightarrow{I} ClCH_2CH_2Cl \xrightarrow{II} CH_2 = CHCl$

(i) Suggest reagents and conditions for stage I and II.

I : _____

II : _____

(ii) Show the mechanism of stage I.

[5 marks]

Section B

Answer any **four** questions from this section.

5. (a) A student investigated the rate of reaction between sodium and ethanol. A freshly cut piece of sodium was weighed and added to a large excess of ethanol.

(i) Write an equation for the reaction between sodium and ethanol. [1 mark]

(ii) Explain why sodium needs to be freshly cut. [1 mark]

The total volume of gas liberated was recorded every minute. The results are given in the table below.

Time/min	0	1	2	3	4	5	6	7
Total volume of gas/cm^3	0	23.0	36.5	46.0	51.0	54.5	57.0	58.5

(iii)Plot the results on a graph. Explain why the experimental results indicate that the overall kinetics is first order. [5 marks]

(iv)In this experiment, the kinetics appears to be zero order with respect to ethanol. Suggest a reason for this. [1 mark]

(b) When a current of 2.21A flows through an aqueous solution of copper sulphate for 28 minutes, 1.22g of copper is deposited at the cathode. Calculate the Avogadro constant from the experiment.

[7 marks]

6 (a) The key reaction during the Contact process for manufacturing sulphuric acid is as follows:-

$2SO_2\,(g) + O_2\,(g) \Leftrightarrow 2SO_3\,(g) \qquad \Delta H = -197\ kJ\ mol^{-1}$

When a 2:1 ratio of sulphur dioxide and oxygen gas at a total initial pressure of 3.0 atm is passed over a catalyst at 430 ^0C, the partial pressure of sulphur trioxide at equilibrium is found to be 1.9 atm.

(i) Calculate the partial pressure of SO_2 and O_2 at equilibrium and hence the new total pressure .

(ii) Write an expression for the equilibrium constant, Kp, and calculate its value.

[6 marks]

(b) In the laboratory preparation of 2-nitrophenol, 4-nitrophenol is also formed. 2-nitrophenol may be separated from 4-nitrophenol by steam distillation. A sample of 2-nitrophenol is obtained by steam distillation at a pressure of 101 kPa.

(i) Give an advantage of steam distillation over fractional distillation. [2 marks]

(ii) Given that the vapour pressure of water at the temperature of the distillation is 95 kPa, calculate the mass of 2-nitrophenol present in 100g of distillate
(M_r of nitrophenol is 139) [5 marks]

(c) The solubility of lead (II) chloride decreases when dilute hydrochloric acid is added but solubility increases on adding concentrated hydrochloric acid. With the aid of equations. explain the observation.

[4 marks]

7. (a) The table below gives some information about the sulphates(VI) of elements in Group 2

Sulphate	Solubility ($mol\ dm^{-3}$)	Lattice enthalphy ($kJ\ mol^{-1}$)	Hydration enthalphy of M^{2+} ($kJ\ mol^{-1}$)
$CaSO_4$	4.6×10^{-2}	-2480	-1650
$SrSO_4$	7.1×10^{-4}	-2484	-1480
$BaSO_4$	4.6×10^{-6}	-2374	-1360

Comment on the trend in the solubilities of these sulphates(VI) in relation to the lattice and hydration enthalpies given in the table. [5 marks]

(b) Na_2O, MgO, Al_2O_3, SiO_2 and P_4O_{10} differ in their physical and chemical properties.

(i) Na_2O and P_4O_{10} dissolve in water whereas the other oxides do not.
(ii) Na_2O, MgO and Al_2O_3 react with acids whereas P_4O_{10}, SiO_2 and Al_2O_3 react with alkalis.

Explain all the above observations. In your answer, show chemical equations wherever possible. [10 marks]

8. (a) Aluminium is used extensively to make cans for carbonated drinks. Due to the high cost involved in the electrolytic extraction of aluminium, the aluminium cans are recycled.
(i) State one property of aluminium that make it suitable for the above purpose.

(ii) Explain why the extraction of aluminium from bauxite is costly.

(iii)Give an important reason for recycling aluminium cans.

(iv) Explain briefly how the recycle process is carried out. [6 marks]

(b) Explain the reactivity of carbon tetrachloride and silicon tetrachloride towards water. [4marks]

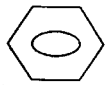
(c) Explain each of the following observations giving equation wherever necessary.
(i) Freshly prepared nitric acid is colourless but turns yellow-brown on standing.

(ii) When ammonium chloride is heated together with calcium oxide, a colourless gas is given off which forms white fumes with concentrated hydrochloric acid.

[5 marks]

9. (a) An organic compound P with relative molecular mass of 58 has the following composition by mass: carbon, 62.07% ; oxygen, 27.59%; and hydrogen, 10.34%.
(i) Determine the empirical formula and molecular formula of P.
(ii) Draw **one** possible isomer for P.

[5 marks]

(b) Compound Z, HO  $CH_2CH_2COCH_3$ has been identified as being responsible for the distinctive aroma of raspberries.

How would you expect Z to react with
(i) alkaline aqueous iodide
(ii) dilute nitric acid
(iii) hydrogen at atmospheric pressure, in the presence of nickel?

[7 marks]

(c) Phenylmethanol, $C_6H_5CH_2OH$ which is immiscible with water has a similar acidity to that of ethanol.
Suggest a method by which you could compare the acidities of phenylmethanol and phenol.

[3 marks]

10. (a) Lactic acid (2-hydroxypropanoic acid), J, occurs in soured milk. It can be synthesized from ethanol by the following series of reaction.

$$C_2H_5OH \xrightarrow{I} G \xrightarrow[HCN + \text{trace } NaCN]{II} H \xrightarrow{III} CH_3CH(OH)COOH \quad (J)$$

Compounds G and H both react with alkaline aqueous iodine. Compound G reacts with 2, 4-dinitrophenylhydrazine and also with Fehling's solution. Compound H reacts with sodium metal.

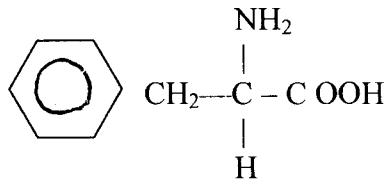
(i) Identify G and H, explaining how the identities you suggest fit in with the test reactions described above.

(ii) Suggest reagents and conditions for reactions I and III. [6 marks]

(b) On heating in the absence of air, lactic acid loses water to give a single compound K, $C_6H_8O_4$. K is a neutral compound that does not react with sodium or with 2, 4-dinitrophenyl hydrazine. Suggest the identity of K.

[3 marks]

(c) Compound A is phenylalanine which is an essential amino acid that must be provided in the diet for healthy growth. A can be synthesized from 3-phenylpropanoic acid.
The structural formula of A is given below.



(i) Name A according to the IUPAC system

(ii) Give an equation for the formation of a tripeptide using only A.

(iii) Give a chemical test to differentiate 3-phenylpropanoic acid from A.

[6 marks]