



Dr. Blosa Science

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525/2
S6 CHEMISTRY

Exam 15

PAPER 2

DURATION: 2 HOUR 30 MINUTES

INSTRUCTIONS

Answer five questions including three questions from section A and any two questions from section B.

Begin each question on a fresh page.

Mathematical tables and graph papers are provided.

Non-programmable scientific electronic calculators may be used.

Illustrate your answer with equations where applicable;

[H= 1, C= 12, O=16, Br = 80, N= 14]

SECTION A

Answer three questions from this section

1a. Explain what is meant by the following terms;

- (i) Molar conductivity 2 marks
(ii) Cell constant 2 marks

(b) A conductivity cell filled with 0.1M aqueous potassium chloride solution gave a resistance at 25°C of 484.0 Ω .

(i) Calculate the cell constant given that the molar conductivity of this solution is 129.0 $\Omega^{-1}\text{cm}^2 \text{mol}^{-1}$ 4 marks

(ii) State and explain factors that affect conductivity of an ion at infinite dilution 3 marks

(c) The following data were obtained for aqueous solution of sodium iodide at 25°C

Concentration (mol dm^{-3})	
0.0095	125.15
0.0027	122.80
0.0050	124.35
0.0100	121.25

(i) Draw a suitable graph and use it to determine the molar conductivity at infinite dilution for sodium iodide (5 marks)

(ii) Explain the shape of the graph in (c) (i). (4 marks)

2. Tin and Lead are members of group IV B of the periodic Table;

(a) Write;

(i) the outer most electronic configuration of the elements. (1 mark)

(ii) the formulae of the common oxides of Lead. (1½marks)

(b) Write equations to show how the oxides of Lead in a(ii) are formed. (4½ marks)

(c) Discuss the reactions of tin and lead with

(i) Sulphuric acid

(ii) Sodium hydroxide solution 8 marks

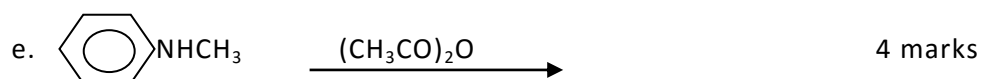
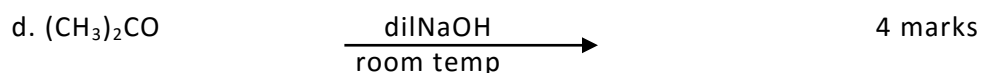
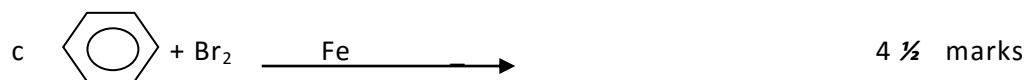
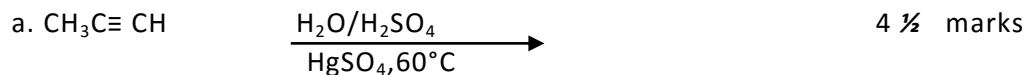
(d) Name one reagent that can be used to distinguish between the following pairs of ions. In each case state what would be observed and write equation(s) for the reaction (s) that take place.

(i) Pb^{2+} and Sn^{2+}

5 marks

(ii) Sn^{2+} and Sn^{4+}

3. Complete the following equations and in each case suggest a mechanism for the reaction.



4a. what is meant by the term voltaic cell? 2 marks

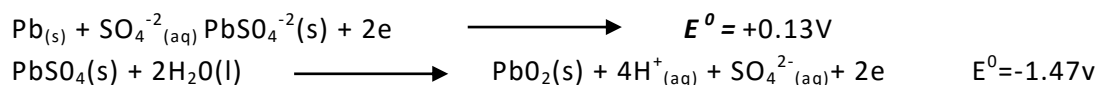
A voltaic cell is an electrochemical cell that uses a chemical reaction to produce electrical energy

(i) With aid of labeled diagram describe briefly how the standard electrode potential of a Voltaic cell made up of silver electrode and aluminium electrode can be determined. 8 marks

(ii) Write the overall equation for the cell reaction. 1 ½ marks

(iii) If the cell liberated 708.9 kJ of heat, determine the e.m.f of the cell. 3 ½ marks

(c) Some electrode potentials of the electrode reactions of an accumulator cell are shown below;



(i) Write the overall cell reaction and hence determine the e.m.f of the cell. 2 ½ marks

(ii) Explain why distilled water is preferred to dilute sulphuric acid when charging an accumulator cell. 2½ marks

SECTION B

Attempt any two questions from this section.

5. 6.2g of a bromoalkane P, $C_nH_{2n+1}Br$ contains 65.04% by mass of bromine

(a) Determine the molecular formula of P. 2 marks

(b) Write the structure formulae and I.U.P.A.C names of all the possible isomers of P. 2 marks

(c) When P is refluxed with aqueous potassium hydroxide, compound Q is formed which formed two layers after five minutes when treated with a mixture of concentrated hydrochloric acid and anhydrous Zinc chloride. Identify;

(i) P

(ii) Q 2 marks

(d) Write equation and suggest a mechanism for the reaction between

(i) P and hot alcoholic potassium hydroxide solution. 2 marks

(ii) P and alkaline solution of phenol. 3 marks

(e) Using equations only show how P can be converted to ethylamine.

5 marks

f. State what would be observed and write equation for the reaction between Q and acidified chromium (VI) oxide.

2½ marks

6a. Distinguish clearly between the terms:

(f) Nuclear fusion and nuclear fission

(g) Decay law and half life

(b) the following data represents the activity of a radioactive isotope ${}^{223}_{87}Fr$

Time (Min)	0	5	10	15	20	25	30	35	40
Activity (counts/min)	680	575	495	425	355	300	265	230	210

(a) Use this data to plot a graph of activity against time.

4 mark

(b) From the graph determine the time for the counts to drop;

(i) to half the original value

1 mark

(ii) from three-quarters to three eighths of the original value

1½ mark

(iii) two thirds to one third of the original value

1½ mark

(h) Using the information in (b) above determine:

- (i) Half life of the radioactive isotope ${}^{223}_{87}\text{Fr}$
- (ii) The order of the decay process. Give a reason for your answer 2marks
- (i) The rate constant for the radioactive decay. Give its units 2marks
- (iii) Radioactive ${}^{223}_{87}\text{Fr}$ has excess proton over neutrons. Explain how this isotope can gain stability. 3marks

7. Explain the following observations

- a. The lattice energy of Lithium fluoride and sodium fluoride are -1029kJmol^{-1} and -904kJmol^{-1} respectively while that magnesium chloride and magnesium oxide are -2492 and -3933kJmol^{-1} respectively. 4 marks
- b. An aqueous solution containing 20.2% hydrochloric acid boils at 108.5°C where as an aqueous solution containing 95.6% ethanol boils at 78.15°C . 4 marks
- c. Magnesium readily reacts with concentrated nitric acid whereas beryllium does not react with concentrated nitric acid. 3 marks
- d. The boiling point of ethanol is higher than that of ethane. 3 marks
- e. Ice is less dense than water. 3 marks
- f. When sodium carbonate solution was added to 2,4,6 - trinitrophenol solution effervescence of a colorless gas occurs whereas when sodium carbonate solution was added to phenol, there is no observable change. 3 marks

- 8a.(i) Describe how cast iron can be extracted from spathic iron ore. 9 marks
- (ii) Name two major impurities in cast iron. 2 marks
- (iii) State how the impurities in cast iron are removed. 2 marks
- b. State what would be observed and write equation for the reaction when the following were added to an aqueous solution of iron (III) chloride.
- (i) Potassium iodide solution 2 marks
- (ii) few drops of concentrated sodium carbonate solution. 3 marks
- (iii) a solution containing 2-hydroxy benzoate ions. 2 marks

END