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525/1

S6 CHEMISTRY

Exam 25

PAPER 1

DURATION: 2 HOUR 45 MINUTES

Instructions:

- This paper consists of three sections (i.e. physical, inorganic and organic)
- Attempt all questions. Answers must be given in the spaces provided.
- Hand in the different sections separately.
- All working/calculations must clearly be shown.

1. (a) Steam distillation is one of the methods used for the separation of a component from a liquid mixture. State one requirement for the component to be separated by steam distillation. (1 mark)

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   (b) A mixture containing a substance Z was steam distilled at 760 mmHg and 95^{o}C. The distillate contained 85% by mass of water. If the vapour pressure of water is 734mmHg at 95^{o}C, calculate the formula mass of x.

   (3 marks)

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2. The table shows the rates of the reaction between substances A and B at different conditions.

Experiment	Initial concentration in moldm $^{-3}$		Initial rate of reaction in moldm $^{-3}$ s $^{-1}$
	A	B	
1	0.50	0.50	2.0×10^{-2}
2	1.00	0.50	8.0×10^{-2}
3	1.00	1.00	16.0×10^{-2}

(a) Determine

(i) the order of reaction with respect to A and B

A……

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(1 mark)

B……

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(1 mark)

(ii) The overall order of the reaction (1 mark)

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(b) (i) Write an expression for the rate of the reaction (1 mark)

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(ii) Calculate the rate constant for the reaction and state the units

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(2marks)

3. (a) (i) What is meant by the term colligative property? (1 mark)

(ii) 1.45g of compound Y was dissolved in 80g of ethanol. The boiling point of the solution was 78.97^0C while that of pure ethanol is 78.8^oC (Kb of ethanol is 1.15^oC for 1 mole in 1000g). Calculate the molecular mass of Y (4 marks)

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(c) (i) Explain the term mole fraction

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(ii) Calculate the mole fraction of sodium chloride in an aqueous solution containing 10g of sodium chloride per 100g of water.
(Na = 23, Cl = 35.5) (3 marks)

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4. (a) Define the term first ionization energy

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The table below gives four ionization energies in kJmol $^{-1}$ for four elements in the same short period.

Element	Ionization energies in kJmol $^{-1}$			
	First	Second	Third	Fourth
W	577	1816	2745	11575
X	738	1450	7730	10550
Y	495	4563	6912	9540
Z	1255	2297	3849	6540

One of the elements belongs to group (VII)

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(b) (i) Arrange the elements in order of increasing atomic number (1 mark)

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(ii) Which of the elements will form an ionic compound 1:1 with each other. Give a reason.

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(iii) Which element will form an ion of +2 Oxidation State? Give a reason

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5. (a) Sketch and name the shape of the following species whose central atom has atomic number as shown

B = 5 N = 7 S = 16 P = 15

Species	Shape	Name of shape
BCl_3		
NO_2^-		
H_2S		
PCl_5		

(b) State the conditions and write equations for the reaction between hydrogen peroxide and

(i) Iron (II) ions.

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(ii) Iron (III) ions

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(iii) Iodide ions

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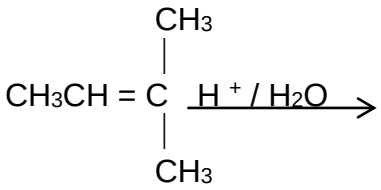
6. A sample of a divalent metal M, contaminated with its oxide was dissolved in 50.0cm^3 of 0.1 M hydrochloric acid. 30.0cm^3 of hydrogen measured at s.t.p was evolved. 20.0 cm^3 of 01M sodium hydroxide was required to neutralise the excess acid. Calculate the percentage of the metal, M.
(1 mole of gas occupies 22.4 dm^3 at s.t.p)

7. Complete the following equation and name the main organic product



8. Name one reagent that can be used to distinguish between the following pairs of compounds. In each case state what would be observed in each case if the reagents are reacted with the compounds.

   (a) (CH3)3COH and CH3CH2CH2OH
   Reagent
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   ……

   Observations
   ……
   ……

   (b) $CH_3C \equiv C\ CH_3$ and $CH_3CH_2\ C \equiv CH$

Reagent

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Observations

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9. State what would be observed and write the name of the product formed when the following pairs of substances are mixed.

(i) $CH_3CH = CH_2$ and a alkaline potassium permanganate solution

Observation

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Formula of product

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Name of product

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(ii) HC ≡ CH and ammoniacal copper (I) chloride solution

Observation

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Formula of product

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Name of product

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(iii) Phenol and bromine water

Observation

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Formula of product

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Name of product

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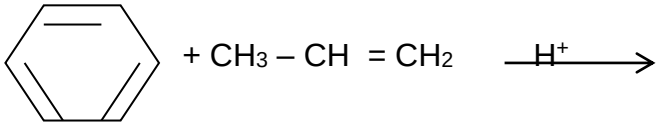
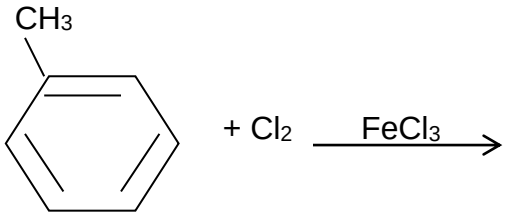
10. Complete the following reaction equations showing their mechanisms.

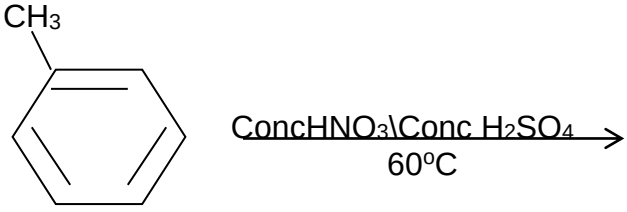
(i)



(ii)



(iii)



(b) Write the names of the products formed in 10. (a) above

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