**Name: ………………………………….................. Signature: .............................**

**P525/1**

**CHEMISTRY**

**PAPER 1**

**2 ¾ HRS**

**JULY/AUG**

**RESOURCEFUL MOCK EXAMINATIONS 2017**

**S.6 CHEMISTRY**

**PAPER 1**

**2 hours 45 minutes**

***INSTRUCTIONS TO CANDIDATES:***

*Answer* ***all*** *questions in Section* ***A*** *and* ***six*** *questions in Section* ***B.***

***All*** *questions must be answered in the spaces provided.*

*The Periodic Table with relevant atomic masses is supplied at the end of the paper.*

*Mathematical tables (3- figure) and non-programmable electronic calculators may be used.*

*Illustrate your answers with equations where applicable.*

*Molar gas constant, R = 8.31JK-1mol-1*

*Molar volume of a gas at s.t.p. is 22.4 litres.*

*Standard temperature = 273 K*

*Standard pressure = 101325Nm-*2

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **For Examiner’s Use Only** | | | | | | | | | | | | | | | | | |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **Total** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

SECTION A (46 Marks)

(Attempt **all questions** in this section)

1. At a certain temperature and a total pressure of 105 pa. Iodine vapour contains 40% by mass of I atoms.

I2(g) 2I(g)

1. Calculate the Kp for the above equilibrium. (02mks)

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1. At what total pressure (without temperature change) would the percentage of iodine atoms be reduced to 20%. (03 mks)

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1. show that the PH of pure water is 7.0 (water ionization constant, Kw = 1.0 x 10-14mol2dm-6(03mks)

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1. For the reaction

A + B C

The following results were obtained for the kinetic runs at the same temperature

|  |  |  |
| --- | --- | --- |
| [A]o/moldm-3 | [B]o/moldm-3 | Initial rate/moldm-3s-1 |
| 0.20 | 0.10 | 0.0002 |
| 0.40 | 0.10 | 0.0008 |
| 0.40 | 0.20 | 0.0008 |

Find

1. The rate equation for the reaction (03 mks)

………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………

1. The rate constant (01 mk)

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1. The initial rate of a reaction, when [A]o = 0.6moldm-3and

[B]o = 0.30moldm-3  (02mk)

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1. For each of the following pairs of compounds, name a reagent that can be used to distinguish them and hence state the observation when each compound is treated with the pair
2. C2H4O2 and C2H2O4 (02 ½ mks)

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1. CH3CH(OH)CH3 and CH3CH2CH2OH (03 mks)

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1. (a)(i) What two factors that determine the solubility of a compound

(0½ mk@)

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1. State how each of the factors required in a(i) affect solubility (02 mks)

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1. Explain why the solubility of M(OH)2, decreases down group II

(03 mks)

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1. (a) What is meant by the term standard state of a substance (01mk)

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1. Mention one method by which standard enthalpy of a reaction can be determined (01 mk)

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1. The standard enthalpies of combustion of graphite and diamond are -393.5 and -395.4 kj/mol respectively. Calculate the change in enthalpy for the reaction below (03 ½ mks)

Graphite diamond

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1. (a). Write the equation of reaction that takes place between each of the following dioxides of group IV with concentrated sodium hydroxide solution (01 ½ mks@)
2. Lead(IV) oxide

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1. Carbon(IV) oxide

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(b) Lead(IV) oxide can be used to prepare lead(IV) chloride.

1. Name the substance that is reacted with lead(IV) oxide to form lead(IV) chloride and the condition for the reaction

Name of substance (01 mark)

……………………………………………………………………………………………............

Condition (0 ½ mk)

………………………………………………………………………………………………………

1. Write the equation for the reaction (01 ½ mks)

………………………………………………………………………………………………………………………………………………………………………………………………………………

1. (a) The emission spectrum of the element hydrogen contains several series of lines.
2. Give a general expression for the energy of the lines in a hydrogen line spectrum. (01 mark)

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1. What do the different lines in a given series have in common (01 marks)

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(b) The frequency of hydrogen at the point of ionization is 32.8 x 1014 Hz. Calculate the ionization energy of hydrogen in KJmol– 1(03 marks)

(Planks constant = 6.6 x 10 – 34Js)

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1. (a) Explain the meaning of the term molar conductivity( 01 mark)

………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………

(b) The following data were obtained for aqueous solutions of potassium fluoride at 25oC.

|  |  |
| --- | --- |
| Concentration / moldm– 3 | Molar conductivity/Ωcm2mol–1 |
| 0**.**0005  0**.**0010  0**.**0027  0**.**0050 | 125**.**15  122**.**80  124**.**35  121**.**25 |

1. Plot a graph of molar conductivity against concentration (03 mks)
2. Using your graph, determine the molar conductivity of potassium fluoride at infinite dilution (01 mks)

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SECTION B (54 marks)

(Attempt **6 questions only** from this section)

1. When concentrated ammonia solution is added dropwise to a solution of chromium (III) sulphate, a green precipitate A forms. A dissolves slowly in excess ammonia solution to give a purple solution B. A also dissolves in excess sodium hydroxide solution to give a green solution C. Addition of hydrogen peroxide to C gives a yellow solution, D. When D is treated with dilute sulphuric acid, it gives an orange solution E.
2. Identify the following (0 ½ mk@)
3. B ………………………………………………………………………………………
4. C ……………………………………………………………………………………….
5. D ………………………………………………………………………………………..
6. E ………………………………………………………………………………………..
7. Write the equation of reaction that is responsible for the formation of

(01 ½ mks @)

1. C ………………………………………………………………………………………
2. D ………………………………………………………………………………………
3. State what is observed and write the equation for the reaction that takes place when sodium nitrite solution is added into solution E followed by about 15cm3 of dilute sulphuric acid
4. Observation (01 ½ mks)

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1. Write the equations of reaction that took place in (c) (03 marks)

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1. The following is data about group II, study it and use it to answer the questions that follow

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Element | Mg | Ca | Sr | Ba |
| Standard enthalpy of hydration/kjmol-1 | -1920 | -1650 | -1480 | -1360 |
| Standard electrode potential E/V | -2.37 | -2.87 | -2.89 | -2.91 |

1. Which element is the most reducing agent?

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1. Give an explanation for your answer in (a)

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1. Write an equation for the reduction of hydrogen by magnesium

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1. Deduce from E values how the elements of group II can be manufactured from their chlorides.

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1. State and explain the trend in enthalpy of hydration

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1. Which of the elements shown in the table above forms
2. The sulphate which is least soluble in water

………………………………………………………………………………………………………

1. The hydroxide which is least stable to heat

………………………………………………………………………………………………………

1. Give a reason for your answer in(f) (i)

………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………

1. An element Y has standard first, second and third ionization enthalpies 738, 1449 and 7728 kjmol-1 respectively. The halides of Y do not colour a flame. If a solution of the nitrate of Y;

* Gave no precipitate with dilute sulphuric acid.
* Gave a white precipitate with sodium carbonate solution.
* Gave a white precipitate with sodium hydroxide which did not dissolve in excess sodium hydroxide.

1. Suggest the identity of Y and give a reason (02 ½ mks)

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1. Give an ionic equation for the reaction between aqueous solution of the nitrate of Y with
2. Sodium carbonate (01 ½ mks)

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1. Sodium hydroxide (01 ½ mks)

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1. Predict the thermal stabilities of the carbonate and hydroxide of Y, giving reasons (03 ½ mks)

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1. A compound containing carbon, hydrogen and nitrogen only was analysed. 0.1g of the compound on combustion gave 0.228g of carbon dioxide and 0.124g of water. On reduction of the compound, all the nitrogen in it was converted into ammonia and it was found that 0.1g of the compound gave ammonia equivalent to 17.2cm3 of 0.1moldm-3 hydrochloric acid.
2. How many moles of carbon, hydrogen and nitrogen are there in 0.1g of the compound. (04 mks)

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1. What is the empirical formula of the compound (01 ½ mks)

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1. The relative molecular mass of the compound was found to be 116. Determine the molecular formula of the compound (01½ mks)

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1. The infra-red spectrum of the compound indicated the presence of –NH2 group. Suggest one possible structure and name of the compound

(02 mks)

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1. (a) State Raoult’s law as applied to mixtures of miscible liquids (01 mk)

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(b) At 50oc, the vapour pressure of hexane and heptane is 54.0kpa and 22.0kpa respectively. Given that a mixture of hexane and heptane obeys raoult’s law.

(i) Draw graphs on the same axis showing how the partial vapour pressure of hexane and heptane and the total vapour pressure vary with the mole fraction for mixtures of hexane and heptane. (02 ½ mks)

(ii) Draw a temperature – composition diagram for the liquid and vapour phases for mixtures of hexane and heptane. Label the diagram. (02 mks)

1. Describe what would happen when a liquid mixture of hexane and heptane containing 40% heptane is fractionally distilled (02 mks)

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1. Calculate the total vapour pressure of a mixture containing 20g of hexane and 30g of heptane (01 ½ mks)

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1. (a) The table below shows values of Kw for water at various temperatures

|  |  |
| --- | --- |
| **Temperature/oc** | **Kw/mol2dm-6** |
| 0 | 0.11x 10-14 |
| 10 | 0.30 x 10-14 |
| 20 | 0.68 x 10-14 |
| 25 | 1.00 x 10-14 |
| 50 | 5.47 x 10-14 |
| 100 | 51.3 x 10-14 |

1. How does the value of Kw change with increase in temperature (0 ½ mks)

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1. Explain the effect of temperature on Kw using le-chatelier’s principle.

(03 mks)

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(b)(i) Calculate the solubility of silver ethanedioate (oxalate), Ag2C2O4in water (Ksp (Ag2C2O4) = 5.0 X 10-12mol3dm-9)

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1. State and explain what would happen to the solubility of silver oxalate if ammonia is added to a saturated solution of silver oxalate containing some undissolved salt. (02 ½ mks)

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1. Use the information in the following table to explain the statements below

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Element | Na | Mg | Al | Si | P | S | Cl |
| Atomic radius/nm | 0.156 | 0.136 | 0.125 | 0.117 | 0.110 | 0.104 | 0.099 |
| Ionic radius/nm | 0.095 | 0.065 | 0.050 |  |  | 0.184 | 0.181 |
| First ionization energy/ kjmol-1 | +492 | +743 | +579 | +791 | +1060 | +1003 | +1254 |

1. The first ionization energies show a general increase from sodium to chlorine (03 marks)

………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………

1. The first ionization energy of aluminium is less than that for magnesium

(03 marks)

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1. The ionic radii of Na+, Mg2+ and Al3+ are less than their respective atomic radii, whereas the ionic radii of Cl- and S2- are bigger than their respective atomic radii

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1. Discuss and explain each of the following (03mks@)
2. The ionic nature of magnesium chloride is greater than that of aluminium chloride which in turn is greater than that of silicon tetrachloride

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1. Glucose is more soluble in water than in benzene, but cyclo hexane is more soluble in benzene than in water

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1. Silicon(IV) oxide is a solid at room temperature and does not melt until 1973k whereas carbon dioxide is a gas at room temperature and melts at 217k

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***END***