

Self Assessment Paper

General Instructions :

All questions are compulsory.

Question 1 is of 20 marks having four sub parts, all of which are compulsory.

*Question numbers 2 to 8 carry 2 marks each, with **any two** questions having internal choice.*

*Question numbers 9 to 15 carry 3 marks each, with **any two** questions having an internal choice.*

Question numbers 16 to 18 carry 5 marks each, with an internal choice.

All working, including rough work, should be done on the same sheet as, and adjacent to the rest of the answer.

The intended marks for questions or parts of questions are given in brackets [].

Balanced equations must be given wherever possible and diagrams where they are helpful.

When solving numerical problems, all essential working must be shown.

In working out problems, use the following data:

Gas constant $R = 1.987 \text{ cal deg}^{-1} \text{ mol}^{-1} = 8.314 \text{ JK}^{-1} \text{ mol}^{-1} = 0.0821 \text{ dm}^3 \text{ atm K}^{-1} \text{ mol}^{-1}$

$1 \text{ l atm} = 1 \text{ dm}^3 \text{ atm} = 101.3 \text{ J}$. $1 \text{ Faraday} = 96500 \text{ coulombs}$.

Avogadro's number $= 6.023 \times 10^{23}$

Question 1

(a) Fill in the blanks by choosing the appropriate word/words from those given in the brackets: [4×1]
(nuclear, P_2O_5 , ΔH , non-polar, NaNH_2 , geometrical, ΔS , polar, two, skeletal, ΔU , one, ΔG)

(i) CO_2 molecule is regarded as a _____ molecule although it contains _____ polar bonds.

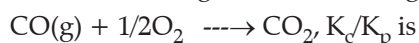
(ii) For a chemical process, $q_p =$ _____ but $q_v =$ _____.

(iii) Chain isomerism is also referred as _____ isomerism or _____ isomerism.

(iv) _____ is a better dehydrohalogenating agent as compared to _____.

(b) Complete the following statements by selecting the correct alternative from the choices given: [4×1]

(i) For the following reactions in the gaseous phase,



(1) $(RT)^{1/2}$

(2) $(RT)^{-1/2}$

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- (3) RT
(4) $(RT)^{-1}$
- (ii) In Van der Waals equation of state, the constant b is a measure of :
- (1) intermolecular repulsion
(2) intermolecular attraction
(3) volume occupied by the molecules.
(4) intermolecular collisions per unit volume.
- (iii) The entropy of the universe
- (1) is increasing and tending towards a maximum value
(2) is decreasing and tending towards zero
(3) remains constant
(4) decreasing and increasing with a periodic rate
- (iv) Nitration of benzene by nitric acid and sulphuric acid is
- (1) electrophilic substitution
(2) electrophilic addition
(3) nucleophilic substitution
(4) free radical substitution

(c) Match the following:

[4x1]

- | | |
|-------------------------------|---------------------|
| (i) Friedel-Craft's acylation | (a) act as catalyst |
| (ii) Aluminium oxide | (b) N_2 |
| (iii) CN^- | (c) CH_3CO^+ |
| (iv) Transition elements | (d) Amphoteric |

(d) Answer the following questions:

[4x2]

- (i) (1) Which of the following are iso-electronic species?
 Na^+ , Mg^{2+} , Ca^{2+} , S^{2-}
(2) Which atoms are indicated by the following configuration?
(a) $[Ne] 3s^2 3p^3$ (b) $[Ar] 4s^2 3d^1$
- (ii) (1) Which element among Cl and F would you expect to have lower first ionisation energy?
(2) Which element do you think would have been named by Lawrence Berkeley Laboratory.
- (iii) (1) What is common in the electronic configuration of H and alkali metals?
(2) Why is LiH least reactive of all the saline hydrides?
- (iv) (1) What happens when acetylene is treated with hypochlorous acid?
(2) How do you prepare acetylene from CaC_2 ?

Question 2

[2]

- (a) 1.5 g of an organic compound in a quantitative determination of phosphorus gave 2.5090 g of $Mg_2P_2O_7$. Calculate the percentage of phosphorus in the compound.

OR

- (b) 0.1170 g of an organic compound on heating with conc. HNO_3 and silver nitrate in Carius furnace gave 0.42g of $AgCl$. Find the percentage of chlorine in the sample.

Question 3

[2]

Complete and balance the following equations :

- (i) $BCl_3(g) + H_2(g) \xrightarrow{1270K} \text{_____} + \text{_____}$
- (ii) $H_3BO_3 + C_2H_5OH \xrightarrow{\Delta} \text{_____} + \text{_____}$

Question 4

[2]

0.05 g of a gas at 750 mm Hg pressure and 25° C occupy a volume of 46.5 ml. Calculate the molecular mass of the gas.

Question 5

[2]

Write the structural formula of following compounds :

- (i) 2-keto-3-methylbutanamide
- (ii) 1-bromo-3-chlorocyclohexane

Question 6

[2]

Why does hydrogen occur in a diatomic form rather than in a monoatomic form under normal conditions ?

Question 7

[2]

- (a) (i) How would you convert n-butane to iso-butane ?
- (ii) Name the product obtained on addition of a water molecule of propene in the presence of dil. H_2SO_4 .

OR

- (b) What happens when
 - (i) Benzene is treated with ozone and the product is subjected to hydrolysis.
 - (ii) Phenol is heated with zinc dust.

Question 8

[2]

Describe the shapes of BF_3 and BH_4^- . Assign the hybridization of boron in these species.

Question 9

[3]

Which hybrid orbitals are used by carbon atoms in the following molecules ?

- (a) CH_3-CH_3
- (b) $\text{CH}_3-\text{CH}=\text{CH}_2$
- (c) $\text{CH}_3-\text{CH}_2-\text{OH}$

Question 10

[3]

- (a) Hydrogen and oxygen combine to form two compounds, water and hydrogen peroxide. If the percentage of oxygen is 88.89 in water and 94.12 in hydrogen peroxide, show that the data support the law of multiple proportions.

OR

- (b) 1470 cm^3 of the gas is collected over water at 303 K and 74.4 cm of Hg. If the gas weighs 1.98 g and vapour pressure of water at 30°C is 3.2 cm of Hg, calculate the molecular weight of the gas.

Question 11

[3]

State any three limitations of Bohr's model?

Question 12

[3]

- (a) Calculate the heat of formation of anhydrous Al_2Cl_6 from the following data :

- (i) $2\text{Al} + 6\text{HCl}(aq) \longrightarrow \text{Al}_2\text{Cl}_6(aq) + 3\text{H}_2(g)$;
 $\Delta H = -239.76 \text{ kcal}$
- (ii) $\text{Al}_2\text{Cl}_6(s) + aq \longrightarrow \text{Al}_2\text{Cl}_6(aq)$; $\Delta H = -153.69 \text{ kcal}$
- (iii) $\text{H}_2(g) + \text{Cl}_2(g) \longrightarrow 2\text{HCl}(g)$; $\Delta H = -44 \text{ kcal}$
- (iv) $\text{HCl}(g) + aq \longrightarrow \text{HCl}(aq)$; $\Delta H = -17.31 \text{ kcal}$

OR

- (b) (i) What do you understand by a spontaneous process? Give two examples.
- (ii) Define Gibb's free energy and free energy change.

Question 13

[3]

- (i) What are green chemicals?

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- (ii) What do you understand by BOD and COD?
 (iii) Name three important greenhouse gases.

Question 14**[3]**

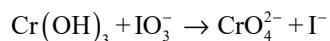
What are Grignard reagents and how are they prepared? What happens when a Grignard reagent is treated with water?

Question 15**[3]**

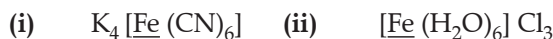
Compare atomic orbital with molecular orbital.

Question 16**[5]**

- (a) (i) Balance the given equation in basic medium by ion-electron method.



- (ii) Calculate the oxidation number of the underline atom in the following species;



- (iii) The compound AgF_2 is unstable compound. However, if formed, the compound acts as a very strong oxidising agent. Why?

OR

- (b) (i) Balance the following equation by oxidation number method.



(basic medium)

- (ii) Identify the substance undergoing oxidation, the substance undergoing reduction, the oxidising agent and the reducing agent in each of the following reactions.



- (iii) Write formulas for the following compounds :

- (1) Iron(III) sulphate
 (2) Chromium(III) oxide

Question 17**[5]**

- (a) (i) Why does benzene behave as a stable compound although it contains three double bonds?
 (ii) Why alkanes do not possess much chemical reactivity under ordinary conditions ?
 (iii) How will you convert
 (1) Ethyl alcohol to ethene
 (2) Propene to 2,3-dimethyl butane
 (3) Ethyne to ethane

OR

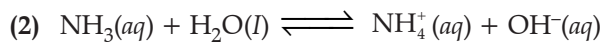
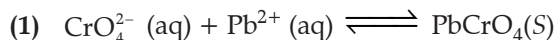
- (b) An organic compound (A) having molecular formula $\text{C}_2\text{HCl}_3\text{O}$ reduces Fehling's solution and on oxidation gives a monocarboxylic acid (B) with molecular formula $\text{C}_2\text{HCl}_3\text{O}_2$. Upon distillation with sodalime, (B) gives a sweet-smelling liquid (C) containing 89.12% chlorine. (C) can also be obtained by heating (A) with alkali. Identify (A), (B) and (C) and explain the reaction involved.

Question 18**[5]**

- (a) (i) How much PCl_5 must be taken in a 9.2 L vessel to get 0.5 moles of Cl_2 at a particular temperature? The value of equilibrium constant (K_c) at the given temperature is 0.0414.
 (ii) How much CH_3COONa should be added to 1 litre of 0.01M CH_3COOH to make a buffer of pH = 4.1 ? K_a for $\text{CH}_3\text{COOH} = 1.8 \times 10^{-5}$

OR

(b) (i) Write the equilibrium constant expressions for the following reactions.



(ii) If 25.0 cm^3 of $0.050 \text{ M Ba(NO}_3)_2$ are mixed with 25.0 cm^3 of 0.020 M NaF , will any BaF_2 precipitated ?
 K_{sp} of BaF_2 is 1.7×10^{-6} at 298 K .

□□□

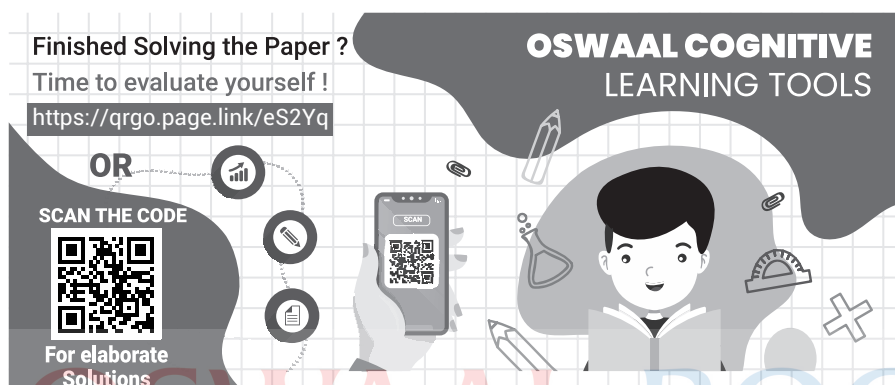
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Time to evaluate yourself !
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OR

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