TEST

1. Which of the following ions is smallest, why?
    N^{3-}, O^{2-}, F^-

2. Write the conjugate bases for NH_4^+, HCO_3^-.

3. What is meant by common ion effect?

4. (a) State the law of constant composition.
    (b) Why is the molality of solution independent of temperature?

5. (a) predict the sign of ΔS for the following reaction:

    $CaCO_3(s) \xrightarrow{heat} CaO(s) + CO_2(g)$

    (b) State Hess's law.

    OR

    Define:
    (a) Standard enthalpy of formation.
    (b) Standard enthalpy of neutralisation.

6. Calculate the bond order of N_2 and N_2^+ and compare their stability.

7. (a) Which series of lines of the hydrogen spectrum lies in UV region?
    (b)the mass of electron is 9.1×10^{-31} kg. If its K.E. is 3×10^{-25} J, calculate its wavelength. (h = 6.626×10^{-34}J s)

8. (a) Define Hund's rule.
    (b) Write the electronic configuration of $Cr^{3+}(24)$.
    (c) Define Pauli's exclusion principle.

9. Give reasons:
    (a) Why are cations smaller than neutral atoms?
    (b) Fluorine has lower electron gain enthalpy than chlorine.
    (c) Sulphur has lesser ionisation enthalpy than phosphorous.

10. (a) Which of the following has minimum bond angle? H_2O, CO_2, NH_3, CH_4
    (b) (i) why is σ - bond stronger than π - bond?
    (ii) how many σ and π – bonds are present in the following compound:
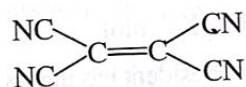


11. Define the following:
    (a) Critical temperature   (b) Avogadro law   (c) Charles's law
    OR
    (a) Define most probable velocity.
    (b) Calculate the temperature at which the average speed of oxygen equals to that of hydrogen at 20 K.

12. What is the value of equilibrium constant for the following at 400 K?
    $2NOCl (g) \rightleftharpoons 2NO(g) Cl_2 (g)$
    $\Delta H^o = 77.5$ kJ mol^{-1} R = 8.314 JK^{-1} $mol^{-1} \Delta S = 135$ $JK^{-1} mol^{-1}$.

13. (a) The concentration of hydrogen ion sample of soft drink is 4.0×10^{-3}M. What is its pH?
    [log 4 = 0.6021]
    (b)The equilibrium constant 'K' for reaction $H_2(g) + I_2 (g) \rightleftharpoons 2HI(g)$ is 4. What will be 'K''' for the reaction HI (g) $\rightleftharpoons \frac{1}{2}H_2(g) + \frac{1}{2}I_2 (g)$?
    (c) What is solubility product? What is the effect temperature on K_{sp}?

OR

(a) What do you conclude when $Q_c > K_c$?

(b) What is meant by common ion effect?

(c) What is the effect of tempreture on K_w (ionic product of water)?

(d) K_w of water at 373 K is 1×10^{-12}. What will be the pH of H_2O at 373K? Is water acidic, basic or neutral at this temperature?

14. Arrange B, C, N, O in increasing order of their ionisation enthalpy.

15. Which gas law is shown by the following graph?
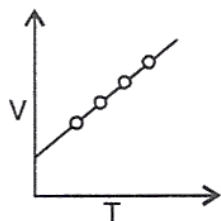
16. Predict the sign of ΔS for the reaction:

$N_2(g) + 3H_2(g) \rightarrow 2\,NH_3(g)$
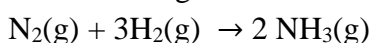
**17.** Write the conjugate acid of a Bronsted base NH_3.

18. Calculate the number of atoms in each of the following :

(a) 7.85 g of Fe (Atomic mass of Fe= 56 u)

(b) 4.68 mg of Si (Atomic mass of Si = 28 u)

19. Elements X, Y and Z have 4, 5 and 7 valence electrons respectively.

(a) Write the molecular formulae of the compounds formed by these elements individually with hydrogen.

(b) Which of these compounds will have the highest dipole moment?

20. Which of the following compounds will not exist as resonance hybrid?give reason for your choice.

CO_3^{2-}, CH_3OH, SO_4^{2-}, C_6H_6
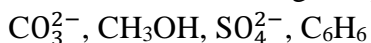
(b) an alcohol (boiling point 97°C) was mixed with a hydrocarbon (boiling point 68 °C). Suggest a suitable method to separate them. Explain the reason for your choice.

OR

Calculate the percentage of Cl n organic compound, 0.2175 h of which in the Carius method gave 0.5825 g ofAgCl.

21. (a) What is the difference between intensive and extensive properties?

(b) Calculate the amount of oxygen formed by heating 12.25 g of $KCIO_3$ at STP according to the equation:

$2KCIO_3(s) \xrightarrow{heat} 2KCl(s) + 3O_2(g)$
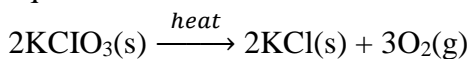
22. (a) What is photoelectric effect?

(b) Account for the following:

(i) The expected electronic configuration of copper is [Ar] $3d^9 4s^2$ but actually it is [Ar] $3d^{10} 4s^1$.

(ii) In building up of atoms, the filling of 4s – orbitals occurs before 3d – orbitals.

23. (a) Write electronic configuration of Cu^+ ion (Z = 29).

(b) Calculate the de Broglie wavelength of milligram sized object moving with 1% speed of light. Planck's constant (h) = 6.63×10^{-34} kg m² s⁻¹, Velocity of light (c) = 3.0×10^8 m s⁻¹

24. (a) Which hybrid orbitals are used by carbon in compound CH_3COOH?

(b) Predict the shape of PF_5 using VSEPR model.

(c) Write one difference between a sigma bond and a pi bond.

25. (a) for the equilibrium,

$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ at 298 K, K = 1.8×10^{-7}. Calculate $\Delta G°$ for the reaction. (R = 8.314 J K^{-1} mol^{-1})

(b) What will be the sign of ΔS for the reaction:

$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ – Heat

Give reason in support of your support.

26. (a) Calculate pH of an aqueous solution of 1.0 M ammonium formate assuming complete dissociation. (pK$_a$ of HCOOH = 3.8 and pK$_b$ of NH$_3$= 4.8)

(b) State the formula of conjugate base of each of the following acids:

(i)H_3O^+ (ii) HSO_4^- (iii) H_3PO_4 (iv) $CH_3NH_3^+$

27. Arrange the following in increasing order of basically:

F$^-$, Br $^-$, Cl$^-$, I$^-$

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OR

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(a) State the formula of conjugate acid of the following:

(i) OH$^-$ (ii) CO_3^{2-} (iii) $(CH_3)_2NH$ (iv) HPO_4^{2-}

(b) Saccharine (K$_a$ = 2×10^{-12}) is a weak acid represented by formula HSac. 4×10^{-4}mol of saccharine is dissolved in 200 cm^3 water having pH . Assuming no change in volume, calculate concentration of Sac $^-$ ion in resulting solution.

28. Write the IUPAC name and symbol for the element with atomic number 115.

29. What will be the sign of work done in the following equation?

$2SO_2 (g) + O_2(g) \rightleftharpoons 2SO_3 (g)$

30. Write K$_p$ in terms of K$_c$ for the following chemical equation:

$N_2 (g) + 3H_2 (g) \rightleftharpoons 2 NH_3(g)$

31. Arrange the following in order of property mentioned:

NaCl,NaBr, NaF, NaI (increasing ionic character).

32. Account for the following:

(a) NF$_3$ is pyramidal while BF$_3$ is triangular planar.

(b) Bond angle in H$_2$O is larger than bond angle in H$_2$S.

33. (a) The enthalpy of neutralisation of weak acid and strong base is less than 57.1 kJ mol^{-1}. Why?

(b) Why is ΔU a state function?

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OR

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State the first law of thermodynamics. Give its mathematical expression.

34. (a) state Avogadro's law.

(b) what mass of excess of CaCO$_3$ with 25 ml of 0.75 M HCl according to the equation:

$CaCO_3 (s) + 2 HCl (aq) \rightarrow CaCl_2 (aq) + CO_2 (g) + H_2O (l)$

[Atomicmass of Ca = 40 u, C = 12 u, O = 16 u,Cl = 35.5 u, H = 1 u]

35. (a) One unpaired electron in atom contributes a magnetic moment o 1.1 BM. Calculate the magnetic moment of chromium. (At. No. of Cr = 24)

(b) The uncertainty in the position and velocity of a particle are 10^{-2}m and 5.27×10^{-24} m s^{-1} respectively. Calculate the mass of the particle (h = 6.62×10^{-34} kg m^2 s^{-1}).

36. (a) StateAufbau's principle.

(b) Account for the following:

(i) 'N' has electronic configuration:

$1s^2 2s^2 2p_x^1 2p_y^1 2p_z^1$ and not $1s^2 2s^2 2p_x^2 2p_y^1$

(ii) Bohr's orbits are called stationary states.

37. Account for the following:

(a) Ionisation enthalpy of 'Ne' is more than 'F' although 'Ne' has bigger atomic size than 'F'.

(b) Al^{3+} is smaller than Mg^{2+} although both are isoelectronic.

(c) Noble gases have low boiling points.

38. (a) Write the molecular orbital configuration of O_2^+. Calculate the bond order and predict its magnetic behaviour.
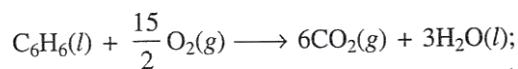
(b) What is the state of hybridisation of 'N' in N O_3^-?

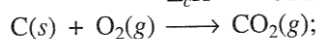**39.** (a) What is the SI unit of density?

(b) Calculate the volume occupied by 88 g of CO_2 at 30°C and 1 bar pressure.

(R = 0.083 bar L K^{-1} mol^{-1})

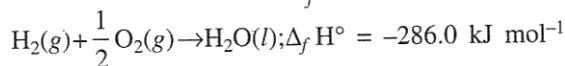**40.** Calculate the standard enthalpy of formation of $C_6H_6(l)$ form the following data:

$$C_6H_6(l) + \frac{15}{2} O_2(g) \longrightarrow 6CO_2(g) + 3H_2O(l);$$
$$\Delta_c H° = -3266.0 \text{ kJ mol}^{-1}$$
$$C(s) + O_2(g) \longrightarrow CO_2(g);$$
$$\Delta_f H° = -393.1 \text{ kJ mol}^{-1}$$
$$H_2(g) + \frac{1}{2} O_2(g) \rightarrow H_2O(l); \Delta_f H° = -286.0 \text{ kJ mol}^{-1}$$

41. (a) Write conjugate base of NH_4^+.

(b) Calculate pH of 1.0×10^{-8} M solution of NaOH.

(c) Calculate the solubility of $Ca_3(PO_4)_2$ in pure water if its solubility product is 1.08×10^{-23}.

OR

(a) write the conjugate base of NH_3.

(b) Give reasons:

(i) A solution of $CuSO_4$ has pH less than 7.

(ii) In qualitative analysis, H_2S is passed in acidic medium for group II.

(c) state Le Chatelier's principle. What is the effect of temperature in

(i)exothermic   (ii) endothermic reversible reactions?

42. Arrange the following in increasing order of ionic radii:

F^-, O^{2-}, Mg^{2+}, Na^+

43. Why are the droplets of water spherical in shape?

44. What is the sign of ΔG for spontaneous process?

45. What is the relationship between K_p and K_c for the following reaction?

$NH_4Cl(s) \rightleftharpoons NH_3 (g) + HCl (g)$

46. The density of 3 molal solution of NaCl is 1.110 g ml^{-1}. Calculate the molarity of the solution.

OR

1 M solution of $NaNO_3$ has density 1.25 gcm^{-3}. Calculate the molality.

[Molar mass of $NaNO_3$ is 85 g mol^{-1}].

47. Conc. H_2SO_4 is 98% by mas and has density 1.84 g cm^{-3}. What volume of concentrated acid is required to make 5.0 L of 0.5 M H_2SO_4 solution?

48. (a) State Heisenberg's uncertainty principle.

(b) An electron has 0.1 nm uncertainty in position. What will be the uncertainty in velocity.

[$m_e = 9.1 \times 10^{-31}$ kg, h = 6.626×10^{-34} Js]

49. (a) write all the four quantum numbers of an electron in the valence shell of Rb(37).

(b) Calculate the ratio of velocities of electron and proton if both have equal wavelength.

[$m_e = 9.1 \times 10^{-31}$ kg , $m_p = 1.75 \times 10^{-27}$ kg]

50. Calculate the bond of H_2^+, He_2^+ and O_2 after writing their electronic configuration. Predict their magnetic behaviour also.

51. (a) Critical temperature of H_2, He, O_2 , N_2 are 33.2 K, 5.3 K, 154.3 K and 126 K respectively. Arrange them in the order of liquefaction of gases.

(b) How is the viscosity affected by increase in temperature.

(c) Under which conditions, a gasdeviates most from an ideal gas behaviour?

52. On the basis of Le Chatelier's principle, explain how temperature and pressure can be adjusted to increase the yield of ammonia in the following reaction:

$N_2 (g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$; ΔH = =-92.38 kJ mol^{-1}

What will be the effect of addition of argon to the above reaction mixture at constant volume?

(b) Calculate the pH of 10^{-8} M HCl solution.

OR

(a) The value of K_c for the reaction $2HI (g) \rightleftharpoons H_2 (g) + I_2 (g)$ is 1×10^{-4}.

At a given time, the composition of reaction mixture is

$[HI] = 2 \times 10^{-5}$ M, $[H_2] = 1 \times 10^{-5}$ M and $[I_2] = 1 \times 10^{-5}$ M

In which direction will the reaction proceed?