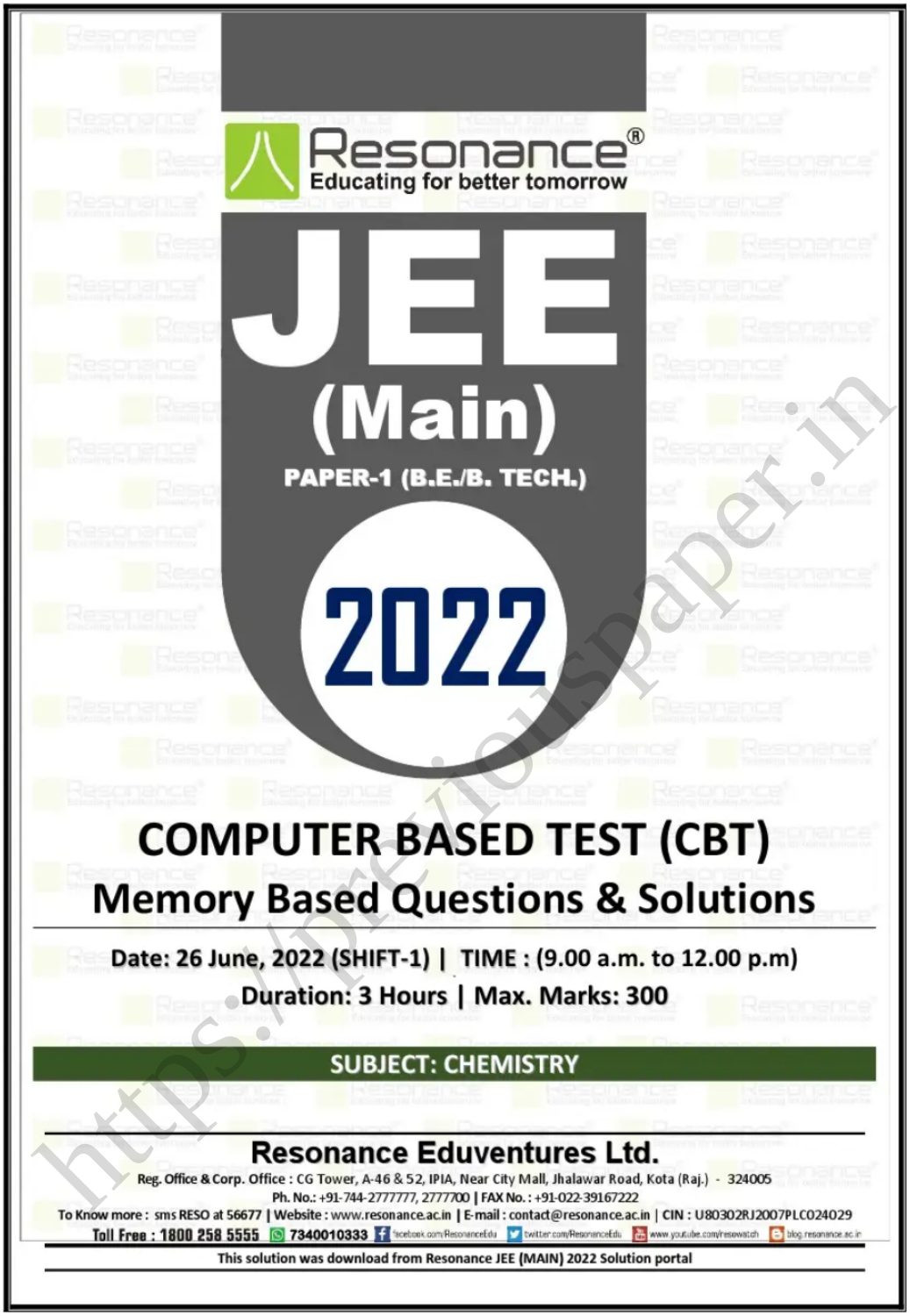

JEE (Main)

PAPER-1 (B.E./B. TECH.)

2022

COMPUTER BASED TEST (CBT)

Memory Based Questions & Solutions

Date: 26 June, 2022 (SHIFT-1) | TIME : (9.00 a.m. to 12.00 p.m)

Duration: 3 Hours | Max. Marks: 300

SUBJECT: CHEMISTRY

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PART : CHEMISTRY

1. Which one of the following metal is best used for standard half electrode?

(1) $\left(\frac{dE}{dT}\right)_p = 10^{-4}$ (2) $\left(\frac{dE}{dT}\right)_p = 2\times10^{-4}$

(3) $\left(\frac{dE}{dT}\right)_p = 0.1\times10^{-4}$ (4) $\left(\frac{dE}{dT}\right)_p = 0.2\times10^{-4}$

Ans. (3)

Sol. Metal which have lower value of $\left(\frac{dE}{dT}\right)_p$ is best used for standard half electrode.

2. If weight of an empty glass vessel is 40g. If this vessel is filled with a liquid (d =0.95 g/ml) then the total weight of vessel is 135g. Now the above empty glass vessel is filled with an unknown gas at 250K and 0.82 atm. Then total Weight of glass vessel is 40.5 g, then molar mass of filled unknown gas is:

[Given : R= 0.0821L-atmK^{-1} mol^{-1}]

(1) 55 (2) 125 (3) 75 (4) 35

Ans. (2)

Sol. Weight of gas = 40.5–40 =0.5g

Mass of liquid = 135.5–40 = 95g.

Volume of glass vessel = $\frac{95.0g}{0.95g/ml}$

= 100 ml.

$\therefore PV = \left(\frac{W}{M}\right)RT$

$(0.82\ atm)\ (100 \times 10^{-3}) = \left(\frac{0.5}{M}\right)(0.0821)(250)$

$M = 125\ g/mol$

3. If 2 gram of $H_2(g)$ is absorbed on 2.5g of Pt at 1 bar and 300K. What is volume of $H_2(g)$ adsorbed on 1g of Pt ? **(Given : R= 0.083 bar–L K^{-1} mol)**

Ans. 10

Sol. $V_{H_2}(g) = \left(\frac{2}{2}\right)\frac{(0.083)300}{1}$

$= 24.9L$

$\therefore$ Volume of $H_2(g)$ adsorbed on 2.5 Pt = 24.9L

$\therefore$ Volume of $H_2(g)$ adsorbed on 1g Pt $= \frac{24.9}{2.5} = 9.96L \approx 10$

4. Find the correct relation between radius of 3rd and 4th Bohar orbit for H-atom.

(1) $\frac{r_3}{r_4} = \frac{16}{9}$ (2) $\frac{r_3}{r_4} = \frac{9}{16}$ (3) $\frac{r_3}{r_4} = \frac{9}{4}$ (4) $\frac{r_3}{r_4} = \frac{3}{16}$

Ans. (2)

Sol. $r_{n,z} = 0.529\ \frac{n^2}{z}\text{Å}$

$r_{3,H} = 0.529 \times \frac{9}{1}\text{ Å}$

$r_{4,H} = 0.529 \times \frac{16}{1}\text{ Å}$

$\therefore \frac{r_3}{r_4} = \frac{9}{16}$

5. Two elements A and B undergoes in first order reaction separately. If initial Concentrations are equal and their half lives are 100 sec. and 50 sec. respectively. At what time (in sec.) concentration of A will becomes 4 times of B?

Ans. 100

Sol. For first order reaction

$k = \frac{0.693}{t_{1/2}}$

$[A] = 4[B]$

$[A]_0\, e^{-k_A t} = 4[B]_0\, e^{-k_B t}$

$\because$ as $[A]_0 = [B]_0$; $e^{-k_A t} = 4e^{-k_B t}$

$-k_A t = \ln 4 - k_B t$

$\therefore$ $t(k_B - k_A) = 2\ \ell n\ 2$

$t = \frac{2 \times 0.693}{\left(\frac{0.693}{50} - \frac{0.693}{100}\right)} = \frac{2\times 100}{2-1} = 100$ sec.

6. What is the value of pH of resulting solution? When 50 mL, 0.1M CH_3COOH (aq.) is titrated with 25 mL of 0.1M NaOH (aq) solution. [pKa = 4.76] [Report your answer nearest integer]

Ans. 5

Sol.

	$CH_3COOH\ (aq) + NaOH\ (aq.) \rightarrow CH_3COONa\ (aq) + H_2O\ (\ell)$		
milli moles	5	2.5	
After reaction			
milli moles	2.5	–	2.5

Resultant solution is acidic buffer solution with same concentration of acid and salts. So, pH of solution

$pH = pKa = 4.76 \simeq 5.$

7. If freezing point of 0.5 w/w % KCl (aq) (MM = 74.5 g/mol) solution is – 0.24°C. Find the percentage of dissociation of KCl in the solution? [K_f = 1.86 K-kg/mol]

Ans. 91

Sol. $\Delta T_f = iK_f m$

$0.24 = i \times 1.86 \left[\frac{0.5\times1000}{74.5\times99.5}\right]$

$i = 1.91$

$i = (1 + (n - 1)\alpha)$; n = 2 for KCl

so, $1.91 = 1 + \alpha$; $\alpha = 0.91 = 91\%$

8. A container of fixed volume filled with an ideal gas which have $\frac{C_P}{C_V} = 1.4$, is moving with velocity 'v' and then suddenly stoped. In this process no heat loss is observed final increase in temperature (M = Molar mass of gas).

(1) $\frac{Mv^2}{7R}$ (2) $\frac{2Mv^2}{7R}$ (3) $\frac{2Mv^2}{5R}$ (4) $\frac{Mv^2}{5R}$

Ans. (4)

Sol. For gas $\frac{C_P}{C_V} = 1.4$

$\frac{\left(\frac{f}{1}+1\right)R}{\left(\frac{f}{1}\right)R} = 1.4 \quad \Rightarrow \quad f = 5$

$\therefore \quad \Delta U = nC_v(\Delta T) \qquad C_v = \frac{f}{2}R$

ΔU is equal to change in internal energy of gas = $\frac{1}{2}Mv^2$

So, $\frac{1}{2}Mv^2 = 1 \times \frac{5}{2}R\,(\Delta T)$

$\Delta T = \frac{Mv^2}{5R}$

9. Consider complete combustion of CH_3OH.

$CH_3OH(\ell) + \frac{3}{2}O_2(g) \rightarrow CO_2(g) + 2H_2O\,(\ell)$.

If the heat of reaction is measured at 27°C in Bomb calorimeter and it is found to be 786kJ. If heat of combustion of above reaction is –x KJ. Find the value of x.

Ans. 787

Sol. $CH_3OH(\ell) + \frac{3}{2}O_2(g) \rightarrow CO_2(g) + 2H_2O\,(\ell)$.

For chemical reaction : $\Delta H = \Delta U + \Delta n_{(g)} RT$

$\Delta H = -786 + (-1/2)\ 8.314 \times 10^{-3} \times 300$

$= -787.2474$kJ

$\therefore$ x = 787

10. $2HSO_4^- \xrightarrow[\text{hydrolysis}]{\text{electrolysis}} 2H^+ + A + 2SO_4^{2-}$

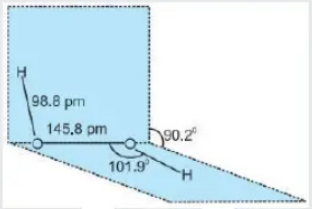
What is the dihedral angle in "A" in solid phase?

(1) 90.2° (2) 111° (3) 111.5° (4) 104°

Ans. (1)

Sol. Peroxodisulphate, obtained by electrolytic oxidation of acidified sulphate solutions at high current density, on hydrolysis yields hydrogen peroxide.

$2HSO_4^-(aq) \xrightarrow{Electrolysis} HO_3SOOSO_3H(aq) \xrightarrow{Hydrolysis} 2HSO_4^-(aq) + 2H^+(aq) + H_2O_2(aq)$



Solid phase

11. Given three complex compounds (I) $PtCl_4.2HCl$ (II) $Ni(H_2O)_6Cl_2$ (III) $CoCl_3(NH_3)_4$

Out of these one compound with excess of $AgNO_3$, gives 2 mol of AgCl and it is octahedral complex. Determine spin only magnetic Moment of compound in BM.

Ans. (3)

Sol. (I) $H_2[PtCl_6] \rightarrow$ no ppt with $AgNO_3$

Pt^{+4}, CN = 6}

(II) $[Ni(H_2O)_6]Cl_2 \xrightarrow[\text{excess}]{AgNO_3}$ 2 mole of AgCl ↓,

Ni^{+2}, CN = 6, n = 2, $\mu_m = \sqrt{n(n+2)}BM = \sqrt{8} = 2.82\ BM \simeq 3$

Aqua complexes, generally have CN = 6

(III) $[CoCl_2(NH_3)_4]Cl \xrightarrow[\text{excess}]{AgNO_3}$ 1 Mole of AgCl ↓,

Co^{+3}, CN= 6

12. The correct order of melting point of given elements is:

(1) Be < Mg < Ca < Sr < Ba (2) Mg < Ba < Sr < Ca < Be

(3) Mg < Be < Sr < Ca < Ba (4) Ba < Be < Ca < Sr < Mg

Ans. (2)

Sol.

Property	Beryllium Be	Magnesium Mg	Calcium Ca	Strontium Sr	Barium Ba	Radium Ra
m.p. / K	1560	924	1124	1062	1002	973

13. Increasing order of bond order is:

(1) $O_2 < O_2^+ < O_2^- < O_2^{-2}$ (2) $O_2^- < O_2^{-2} < O_2^{+2} < O_2$

(3) $O_2^{-2} < O_2^- < O_2 < O_2^+$ (4) $O_2^- < O_2^{-2} < O_2 < O_2^+$

Ans. (3)

Sol.

Species	O_2^{+2}	O_2^{+}	O_2	O_2^{-}	O_2^{-2}
No. of e⁻	14	15	16	17	18
Bond order	3	2.5	2	1.5	1

14. Current order of stability of +1 oxidation state for following is:

(1) $Al^+ > Ga^+ > In^+ > Tl^+$ (2) $Tl^+ > In^+ > Ga^+ > Al^+$

(3) $Tl^+ > In^+ > Tl^+ > Al^+$ (4) $Tl^+ > Ga^+ > In^+ > Al^+$

Ans. (2)

Sol. In boron family as we move down the group, stability of +1 state increase due to insect pair effect

15. Correct order of melting point of following compound is:

(1) $H_2O > H_2S > H_2Se > H_2Te$ (2) $H_2O > H_2Te > H_2Se > H_2S$

(3) $H_2Te > H_2Se > H_2S > H_2O$ (4) $H_2Te > H_2O > H_2Se > H_2S$

Ans. (2)

Sol. In general molar mass ↑, MP ↑ but in H_2O due to H–bonding, it is maximum among the following:

Property	H_2O	H_2S	H_2Se	H_2Te
m.p. / K	273	188	208	222

16. **Statement-I:** In Ellingham diagram metal oxide, having higher value of ΔG is more stable, than metal oxide having less ΔG.

Statement II → In Ellingham diagram lower metal will reduce uppers metal from it's oxide select true (T) and false (F) regarding these statements respectively.

(1) T, T (2) F, F (3) T, F (4) F, T

Ans. (4)

Sol. → Higher value of ΔG like HgO, Ag_2O are less stable.

→ In Ellingham diagram lower situated metals is more reactive, it can reduce higher metal oxide.

17. Amongs V_2O_3, V_2O_4, V_2O_5, determine value of spin only magnetic moment for most basic oxide in BM (Bohr's megnatone):

Ans. (3)

Sol. → V_2O_3 (V^{+3}) is most basic oxide amongs the following

→ Total no. of unpaired electrons in v^{+3} is n = 2.

$_{23}V^{+3}$ = [Ar]$3d^2$

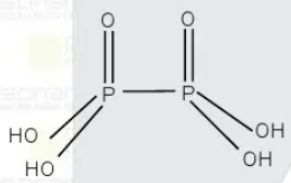
→ $\sqrt{n(n+2)}$ or $\sqrt{8}$ = 2.87BM

18. Amongs the following which on reaction with alkali gives an oxoacid which do not contain P–H bond:

(1) White P (2) Red P (3) P_2P_3 (4) H_3PO_3

Ans. (2)

Sol. Red P on reaction with alkali gives hypophosphoric acid ($H_4P_2O_6$)



19. Select the incorrect option regarding test of NO_3^- radical:
(1) A nitrosyl complex is formed.
(2) A brown ring is obtained in brown ring test at the junction of two liquids.
(3) Formula of brown ring is $[Fe(H_2O)_5(NO)]SO_4$.
(4) When concentrated H_2SO_4 is added to nitrate salt, very light brown fumes appears.

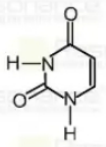
Ans. (4)

Sol. $NO_3^- + H_2SO_4$ (conc.) $\rightarrow NO_2^- \uparrow$ (reddish brown) + $O_2 + SO_4^{2-} + H_2O$

20. A base present in RNA nucleotide, not in DNA, then number of oxygen atom in base is.

Ans. (2)

Sol.



Uracil (U)

21. Which of the given combination is correct.

Column-I	Column-II
(i) Homopolymer	Buna-S
(ii) Fiber	Nylon 6-6
(iii) Condensation polymer	Dacron
(iv) Addition plymer	Teflon

(1) (i), (ii), (iii) (2) (ii), (iii), (iv) (3) (i), (iii), (iv) (4) (i), (ii), (iv)

Ans. (2)

Sol. Buna-S is a copolymer of butadiene and styrene.

22. Polar cloud in stratosphere helps in the formation of which molecule.
(1) ClO (2) $ClONO_2$ (3) CH_4 (4) HOCl

Ans. (1)

Sol. Polar stratospheric clouds (PSCs) surfaces act as catalysts that convert more benign forms of human-made chlorine into active free radicals (for example ClO, chlorine monoxide). During the return of spring sunlight these radicals destroy many ozone molecules in a series of chain reactions.

23. Which of the following leads to the secretion of pepsin in stomach.
(1) Histamine (2) Antihistamine (3) Cimetidine (4) Zintac

Ans. (1)

Sol. Excess of acidity (pepsin in stomach) is due to release of excess of histamine. Therefore modern synthetic drugs are antihistamines for the treatment of gastic ulcers by blocking the acid release action of histamine.

24. 0.3 gram of an organic compound on combustion gives 0.2 gram of CO_2 and 0.1 gram of H_2O. Then the % carbon in compound is.

Ans. (18.11)

Sol. Moles of $CO_2 = \frac{0.2}{44}$

Moles of carbon = $\frac{0.2}{44}$

Weight of carbon = $\frac{0.2}{44} \times 12$ g

44

$$\% \text{ of carbon} = \frac{0.2}{44} \times 12 \times \frac{100}{0.3} = 18.11$$

25. **Statement-I :** In Lassaigne test, organic compound with both N and S, respond to the test of SCN^-.
Statement-II : If Na is taken in excess, it destroy SCN^- and form Na_2S and NaCN.
(1) Statement-I is correct only. (2) Statement-II is correct only.
(3) Both statement-I & II are correct. (4) None of the statement is correct.

Ans. (3)

Sol. Both statement-I & II are correct.
(In case, nitrogen and sulphur both are present in an organic compound, then sodium thiocyanate (Blood red colour) is formed with neutral $FeCl_3$.

$$Na + C + N + S \longrightarrow NaSCN$$

$$\text{Neutral } FeCl_3 + NaSCN \longrightarrow \underset{\text{Blood red}}{Fe(SCN)_3}$$

If Na is taken in excess, it destroy SCN^- and form Na_2S and NaCN.

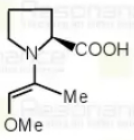
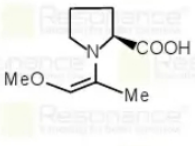
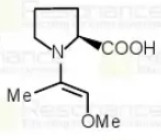
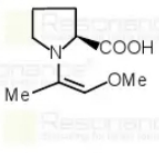
26. A $\xrightarrow{\text{dil } HNO_3}$ P [Intra molecular H bonding], Q [Inter molecular H bonding]

P and Q can be repeated by steam distillation. If A is treated with conc. HNO_3, It gives product R. Total no. of oxygen atom in R is

Ans. (7)

Sol. A $\xrightarrow{\text{dil } HNO_3}$ P (2-nitrophenol), Q (4-nitrophenol)
A $\xrightarrow{\text{Conc. } HNO_3}$ 2,4,6-trinitrophenol (Picric acid)

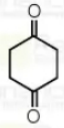
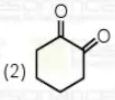
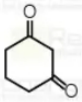
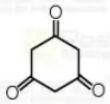
27. Which of the given enamine is most stable

(1) 
(2) 
(3) 
(4) 

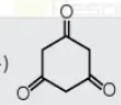
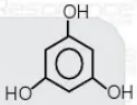
Ans. (4)

Sol. Enamine form is more stable due to intramolecular hydrogen bonding.

28. Enol form of which is most stable.

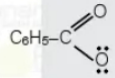
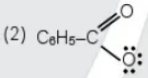
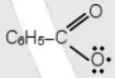
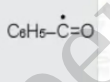
(1)  (2)  (3)  (4) 

Ans. (4)

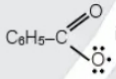
Sol. Enol form of (4)  is more stable due to formation of aromatic  benzene-1,3,5-triol.

29. $(C_6H_5COO)_2 \xrightarrow{\Delta} A \longrightarrow 2C_6H_5^{\bullet} + 2CO_2$

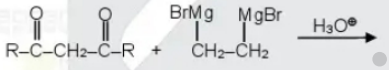
Intermediate [A] in above reaction is

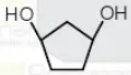
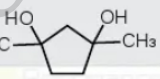
(1)  (2)  (3)  (4) 

Ans. (3)

Sol. Benzoate radical  is formed as intermediate.

30. The product formed in the given reaction is



(1)  (2) 

(3)  (4) $R–CH_2–CH_2–CH_2–R$

Ans. (2)

Sol.