



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

JEE (Main) 2021

Questions & Solutions

(Reproduced from memory retention)

Date : 26 February, 2021 (SHIFT-1) Time ; (9.00 am to 12.00 pm)

Duration : 3 Hours | Max. Marks : 300

SUBJECT : CHEMISTRY

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CHEMISTRY

1. Which of the following compounds is formed by ammonolysis of ethyl chloride and reacts with tosyl-chloride but remains insoluble in KOH?

(1) Ph–NH–PH (2) Et–NH₂ (3) Ph–NH–Pr (4) Et–NH–Pr

Ans. (4)

Sol. Sulphonamides of secondary amine will be insoluble in KOH.

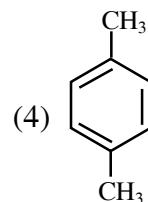
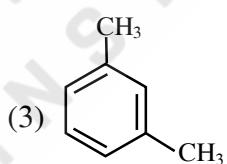
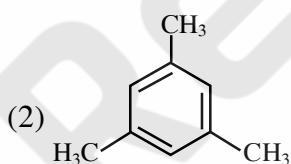
2. Statement-I: Orthonitrophenol has intra molecular H-bonding

Statement-II: Orthonitrophenol has high melting point due to H-bonding.

- (1) Statement I is true, Statement II is false
- (2) Statement I is false, Statement II is true
- (3) Statement I, II both are true
- (4) Statement I, II both are false

Ans. (1)

3. Give the major product (P) of the following reaction



Ans. (2)

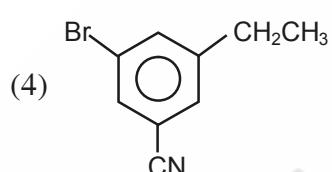
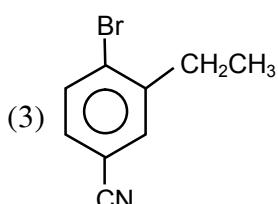
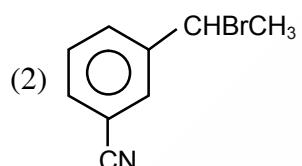
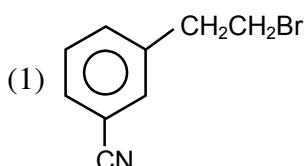
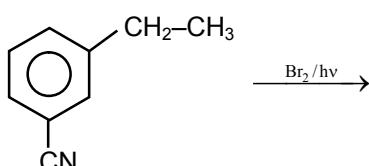
4. Which metal is used in the coagulation of blood ?

(1) Vitamin K (2) Vitamin C (3) Vitamin A (4) Vitamin E

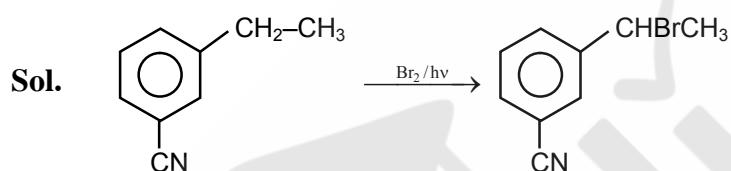
Ans. (1)

Sol. Vitamin K is used by the body to help blood clot. Warfarin (Coumadin) is used to slow blood clotting. By helping the blood clot, vitamin K might decrease the effectiveness of warfarin.

5. What is the major product of the following reaction

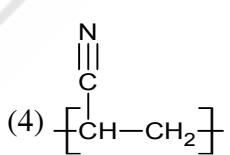
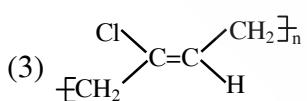
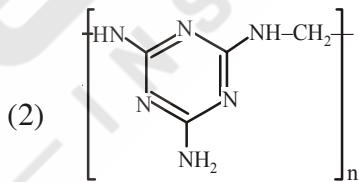
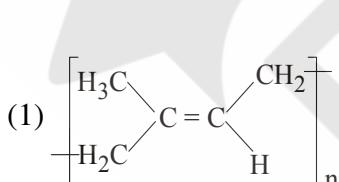


Ans. (2)

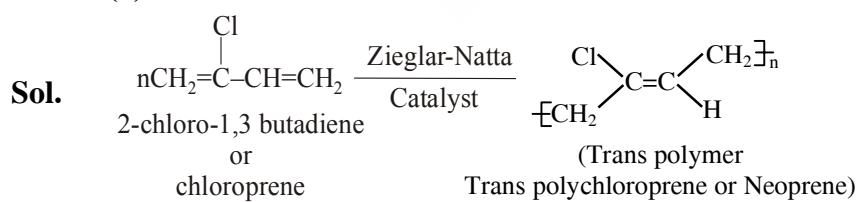


It is free-radical substitution reaction of alkanes, so bromination takes place at benzylic carbon.

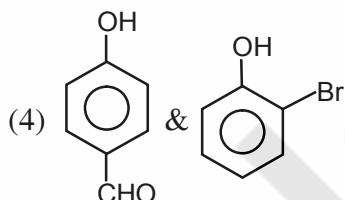
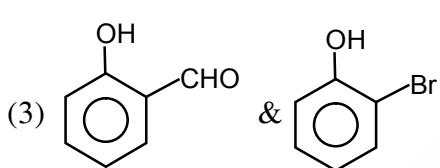
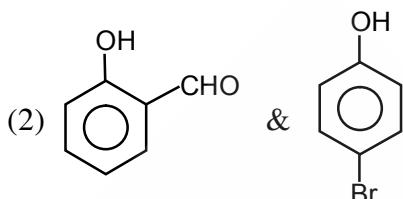
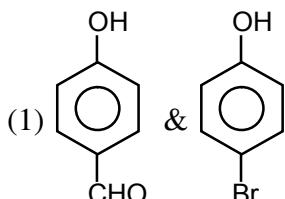
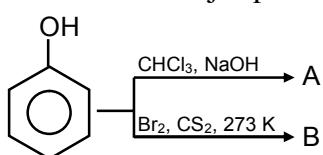
6. What is the structure of neoprene?



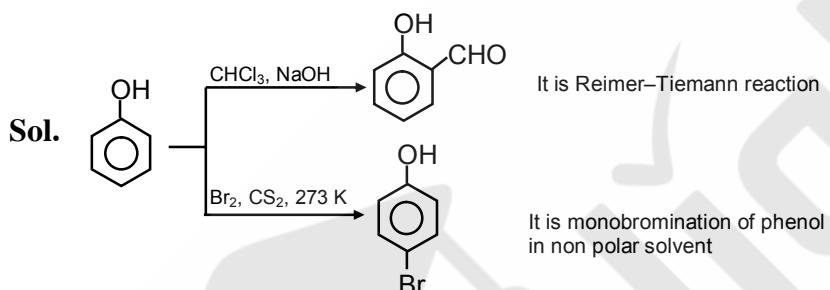
Ans. (3)



7. What will be major product [A] and [B] in the given sequence of reactions ?



Ans. (2)



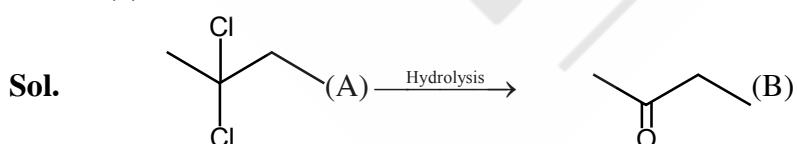
8. $\text{C}_4\text{H}_8\text{Cl}_2$ (A) $\xrightarrow{\text{Hydrolysis}}$ $\text{C}_4\text{H}_8\text{O}$ (B)

B forms oxime with NH_2OH but does not give Tollen's test.

Compound (A) and (B) are respectively :

- | | |
|-------------------------------------|-------------------------------------|
| (1) 2,2-Dichlorobutane & 2-Butanone | (2) 2,2-Dichlorobutane & 2-Butanal |
| (3) 1,1-Dichlorobutane & 2-Butanal | (4) 1,2-Dichlorobutane & 2-Butanone |

Ans. (1)



2-Butanone forms oxime with NH_2OH but does not give Tollen's test.

9. **Statement - I** : Chloroform and aniline is separated by simple distillation.

Statement - II : When we separate water and aniline by steam distillation aniline boils below its boiling point.

- (1) Statement I is true ,Statement II is false
- (2) Statement I is false ,Statement II is true
- (3) Statement I , II both are true
- (4) Statement I , II both are false

Ans. (3)

10. Which statement is false?

- (1) Kjeldal method is used for estimation of nitrogen.
- (2) Carius tube is used for estimation of sulphur
- (3) Carius tube is used for estimation of Nitrogen
- (4) Phosphoric acid is precipitated by adding magnesia mixture on yields $Mg_2P_2O_7$

Ans. (3)

11. A compound on reaction with hot dilute H_2SO_4 liberates a gas 'X' which when brought in contact with $K_2Cr_2O_7$ paper dipped in dil. H_2SO_4 gives a green compound 'Y'.
 'X' and 'Y' respectively are

- | | |
|-----------------------------|-----------------------------|
| (1) SO_3 , $Cr_2(SO_4)_3$ | (2) SO_2 , Cr_2O_3 |
| (3) SO_3 , Cr_2O_3 | (4) SO_2 , $Cr_2(SO_4)_3$ |

Ans. (4)

Sol. Compound + $H_2SO_4 \longrightarrow SO_{2(g)} \xrightarrow{K_2Cr_2O_7} Cr_2(SO_4)_3$
 (sulphite) Hot dil.

12. Which of the following combination is correct?

Ore	Elements
(A) Kernite	(P) Zn
(B) Calamine	(Q) F
(C) Cassiterite	(R) B
(D) Cryolite	(S) Sn
(1) A – R, B – P, C – S, D – Q	(2) A – R, B – Q, C – P, D – S
(3) A – P, B – R, C – S, D – Q	(4) A – Q, B – S, C – P, D – R

Ans. (1)

13. A compound which is used in lead storage battery, having amphoteric nature & is a strong oxidising agent is ?

- (1) PbO_2
- (2) Pb_3O_4
- (3) $PbSO_4$
- (4) PbO

Ans. (1)

14. Which does not form MO_2 ?

- (1) Nd
- (2) Yb
- (3) Dy
- (4) Pr

Ans. (2)

Sol. Yb shows +2 & +3 only

15. Match the following electronic configuration with ΔH_{IE} values :

- | | |
|------------------------|----------|
| (i) $1s^2 2s^2$ | (p) 801 |
| (ii) $1s^2 2s^2 2p^1$ | (p) 899 |
| (iii) $1s^2 2s^2 2p^3$ | (r) 1300 |
| (iv) $1s^2 2s^2 2p^4$ | (s) 1400 |

- | | |
|--|--|
| (1) (i) – q; (ii) – p; (iii) – s; (iv) – r | (2) (i) – q; (ii) – s; (iii) – p; (iv) – r |
| (3) (i) – s; (ii) – q; (iii) – p; (iv) – r | (4) (i) – s; (ii) – p; (iii) – q; (iv) – r |

Ans. (1)

Sol. Order : B < Be < O < N

16. Select the correct statement

- (a) Heavy water is used to determine reaction mechanism
- (b) Viscosity of heavy water is less than that of water
- (c) D_2O can be prepared by exhaustive electrolysis of H_2O
- (d) Boiling point of heavy water is more than that of normal water

- | | | | |
|----------|-------------|----------|-------------|
| (1) a, d | (2) a, b, d | (3) a, c | (4) a, b, c |
|----------|-------------|----------|-------------|

Ans. (1)

Sol. Since extent of intermolecular forces are more in D_2O as compared to H_2O , therefore D_2O has more viscosity as well as Boiling point as compared to H_2O .

17. Statement-I : Dipole-dipole interaction is the only non-covalent interaction force responsible for H-Bonding
 Statement-II : F is the most EN element & HF forms symmetrical H-bond

- (1) Statement I is true ,Statement II is true and Statement II is correct explanation of Statement I
- (2) Statement I is false ,Statement II is true
- (3) Statement I , II both are true
- (4) Statement I , II both are false

Ans. (2)

18. For which of the following orbital, number of angular node and radial node are each 2.

- | | | | |
|--------|--------|--------|--------|
| (1) 5d | (2) 4f | (3) 3p | (4) 2s |
|--------|--------|--------|--------|

Ans. (1)

Sol.

Orbital	Angular Node	Radial Node
5d	2	2
4f	3	0
3p	1	1
2s	0	1

19. O₃ is troposphere

- (1) Form photochemical smog
- (2) Protect us from UV light
- (3)
- (4)

Ans. (1)

20. When dichromate reacts with base. What is the oxidation number of Cr in the product?

Ans. 6



$$x + (-2 \times 4) = -2$$

$$x = 6$$

21. 3.12g of O₂ is adsorbed in 1.2g Pt. Determine volume of O₂ (in L) adsorbed per gm of Pt at 1atm and 300 K

$$R = 0.082 \frac{\text{atm} \cdot \text{L}}{\text{Mol} \cdot \text{K}}$$

Ans. (2)

Sol. Moles of O₂ = $\frac{3.12}{32} = 0.0975$

$$\text{Volume of O}_2 = \frac{nRT}{P} = \frac{0.0975 \times 0.082 \times 300}{1} = 2.3985 \text{ litres} \approx 2.4 \text{ litres}$$

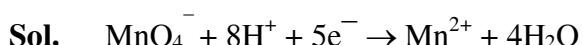
$$\text{Volume of O}_2 \text{ adsorbed per gm of Pt} = \frac{2.4}{1.2} = 2$$

22. MnO₄⁻ + 8H⁺ + 5e⁻ \rightarrow Mn²⁺ + 4H₂O

Determine the amount of current in faraday for conversion of 5 moles of MnO₄⁻ to Mn²⁺.

(Given E°_{MnO₄⁻/Mn²⁺} = 1.51V)

Ans. 25

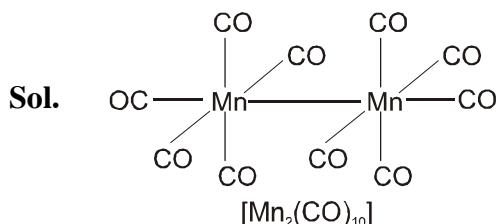


1 mole of MnO₄⁻ require 5 Faraday charge

5 moles of MnO₄⁻ will require 25 Faraday

23. No. of Bridging CO ligands in $\text{Mn}_2(\text{CO})_{10}$ is

Ans. Zero



24. $\Delta H = -20 \text{ kJ/mole}$ E_a for forward = 30 kJ/mole

Determine E_a for backward = ?

Ans. 50 kJ/mole

Sol. $\Delta H = E_a, f - E_{a,b}$

$$-20 = 30 - E_{a,b}$$

$$E_{a,b} = 50 \text{ kJ/mole}$$

25. For a reaction $\Delta H = 80 \text{ kJ}$

$$\Delta S = 2T \text{ J/mole-k}$$

Calculate the minimum temperature at which the reaction will be spontaneous.

Ans. 200 K

Sol. For spontaneous reaction $\Delta G < 0$

$$\Delta H - T\Delta S < 0$$

$$80,000 - (T)(2T) < 0$$

$$2T^2 > 80,000$$

$$T^2 > 40,000$$

$$T > 200 \text{ K}$$

$$\therefore \text{Ans. } 200 \text{ K}$$

26. For a gas $P(V_m - b) = RT$

$$\text{If } \left(\frac{dz}{dp} \right)_T = \frac{x b}{R T} \text{ find } x$$

Ans. 1

Sol. $P(V - b) = RT$

$$PV - Pb = RT$$

$$\frac{PV}{RT} - \frac{Pb}{RT} = 1$$

$$z = 1 + \frac{Pb}{RT}$$

$$\frac{dz}{dp} = 0 + \frac{b}{RT}$$

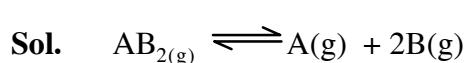
$$= \frac{b}{RT} = \frac{x b}{RT}$$

$$x = 1$$



Starting with 1 mole of AB_2 in 25L container, pressure at equilibrium is found to be 1.9 atm at 300K. If K_p is $x \times 10^{-1}$, determine x.

Ans. 7



$$P_i = \frac{1 \times 1}{12} \times \frac{300}{25}$$

1	-	-	= 1
$1 - x$	x	$2x$	

$$1 + 2x = 1.9$$

$$K_p = \frac{P_A \times (P_B)^2}{P_{AB_2}}$$

$$2x = 0.9$$

$$x = 0.45$$

$$K_p = \frac{9 \times 9 \times 9 \times 20}{20 \times 100 \times 11}$$

$$K_p = \frac{9 \times 9 \times 9}{100 \times 11} = 0.6627 = 6.627 \times 10^{-1}$$