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# JEE

## (Main)

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

# 2021

## COMPUTER BASED TEST (CBT) Memory Based Questions & Solutions

**Date: 25 July, 2021 (SHIFT-1) | TIME : (9.00 a.m. to 12.00 p.m)**

**Duration: 3 Hours | Max. Marks: 300**





**SUBJECT: CHEMISTRY**

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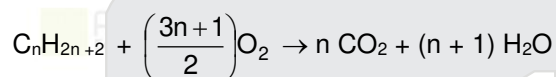
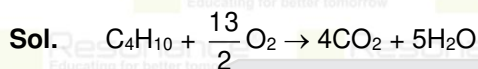


**PART : CHEMISTRY**

1. In the combustion of butane 72gm of H<sub>2</sub>O is produced. The amount of butane taken initially is [X] × 10<sup>-1</sup>.

The value of 'X' is

**Ans.** 464



∴ 1 mole C<sub>4</sub>H<sub>10</sub> produces 5 mole H<sub>2</sub>O.

5 mole (5 × 18) = 90 gm.

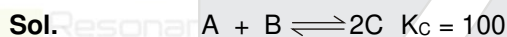
90 gm → 58 gm

72 gm →  $\left(\frac{58 \times 72}{90}\right) = 46.4$  gm

2.  $A+B \rightleftharpoons 2C$ .

Initially 1 mole each of A, B and C are taken in 1 litre vessel. Equilibrium constant is 100. The concentration of C at equilibrium in [X] × 10<sup>-1</sup>. The value of 'X' is

**Ans.** (25)



t = 0    1    1    1

t = t<sub>eq.</sub> 1-x    1-x    1 + 2x

$$K_c = \frac{(1+2x)^2}{(1-x)^2}$$

$$100 = \frac{(1+2x)^2}{(1-x)^2} \text{ of [C]}$$

$$10 = \frac{(1+2x)}{(1-x)}$$

$$X = \frac{3}{4}$$

$$\text{concentration of [C]} = 1 + 2 \left(\frac{3}{4}\right) = 2.5 \times 10^{-1}$$

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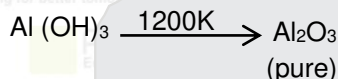
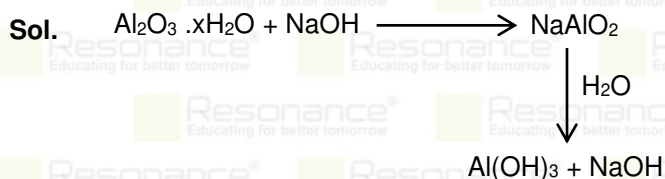
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3. In the leaching of Bauxite, which Oxide is leached out using NaOH.

- (1) Fe<sub>2</sub>O<sub>3</sub>      (2) Al<sub>2</sub>O<sub>3</sub>      (3) TiO<sub>2</sub>      (4) SiO<sub>2</sub>

Ans. (2)



4. Among the given oxides

- (i) CrO<sub>3</sub>      (ii) V<sub>2</sub>O<sub>5</sub>      (iii) Fe<sub>2</sub>O<sub>3</sub>      (iv) MnO<sub>2</sub>

The correct increasing order of oxidation state of metal is

- (1) (i) < (ii) < (iii) < (iv)    (2) (ii) < (iii) < (i) < (iv)    (3) (iii) < (iv) < (i) < (ii)    (4) (iii) < (iv) < (ii) < (i)

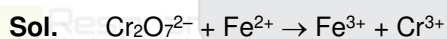
Ans. (4)

Sol.

	Compound	Oxidation state of metal
(i)	CrO <sub>3</sub>	+6
(ii)	V <sub>2</sub> O <sub>5</sub>	+5
(iii)	Fe <sub>2</sub> O <sub>3</sub>	+3
(iv)	MnO <sub>2</sub>	+4

5. Find the concentration of Fe<sup>2+</sup> (10 ml) required to reduce 15 ml of 0.1M K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> Solution is:

Ans. 0.9



15 ml      10 ml

0.1 M

$N_1V_1 = N_2V_2$

$15 \times 0.1 \times 6 = 10 \times M \times 1$

M = 0.9 Molar

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6. Arrange the following ions in the increasing order of size,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Mg}^{+2}$ ,  $\text{Al}^{+3}$ .

- (1)  $\text{Al}^{3+} < \text{Mg}^{2+} < \text{Na}^+ < \text{K}^+$       (2)  $\text{K}^+ < \text{Na}^+ < \text{Al}^{3+} < \text{Mg}^{2+}$   
 (3)  $\text{Al}^{3+} < \text{Mg}^{2+} < \text{K}^+ < \text{Na}^+$       (4)  $\text{Mg}^{2+} < \text{Al}^{3+} < \text{K}^+ < \text{Na}^+$

Ans. (1)

Sol.  $\text{K}^+ > \text{Na}^+$  {moving down the group size increases}

$\text{Na}^+ > \text{Mg}^{2+} > \text{Al}^{3+}$  {Isoelectronic species}

Z	11	12	13
E	10	10	10

7. Henry's law constant for  $\text{CO}_2$  in water in  $0.835 \times 2 \times 10^3$  bar. How many millimoles of  $\text{CO}_2$  would dissolve in 0.9 litre water? Assume  $\text{CO}_2$  gas exerts a partial pressure of 0.853 bar.

Ans. 25

Sol.  $P_{\text{CO}_2} = K_H X_{\text{CO}_2}$

$$X_{\text{CO}_2} = \frac{P_{\text{CO}_2}}{K_H} = \frac{0.835}{0.835 \times 2 \times 10^3}$$

$$X_{\text{CO}_2} = 0.5 \times 10^{-3}$$

$$\text{Number of moles of water} = \frac{900}{18} = 50$$

$$\frac{n_{\text{CO}_2}}{n_{\text{CO}_2} + n_{\text{H}_2\text{O}}} = 0.5 \times 10^{-3}$$

( $n_{\text{CO}_2}$  in denominator is neglected as it is  $\ll 50$ )

$$n_{\text{CO}_2} = 0.5 \times 10^{-3} \times 50 = 25 \times 10^{-3} \text{ moles}$$

$$= 25 \text{ millimoles}$$

8. Which of the following does not exist.

- (1)  $\text{SiF}_6^{2-}$       (2)  $\text{SiCl}_6^{2-}$       (3)  $\text{GeCl}_6^{2-}$       (4)  $\text{Sn}(\text{OH})_6^{2-}$

Ans. (2)

Sol. The main reasons are :

- (i) six large chloride ions cannot be accommodated around  $\text{Si}^{4+}$  due to limitation of its size.  
 (ii) interaction between lone pair of chloride ion and  $\text{Si}^{4+}$  is not very strong.

The species like,  $\text{SiF}_6^{2-}$ ,  $[\text{GeCl}_6]^{2-}$ ,  $[\text{Sn}(\text{OH})_6]^{2-}$  exist where the hybridisation of the central atom is  $\text{sp}^3\text{d}^2$ .

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9. Which of the following complex is active in magnetic field.

- (1)  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$       (2)  $[\text{Co}(\text{CN})_6]^{3-}$       (3)  $[\text{Ni}(\text{Co})_4]$       (4)  $[\text{Ni}(\text{CN})_4]^{2-}$

Ans. (1)

Sol.  $\text{Fe}^{3+}; 3d^5$

If will contain 5 unpaired electrons.

Thus it is paramagnetic and attracted in external magnetic field.

10. Empirical formula of a given octahedral complex is  $\text{CrCl}_3 \cdot 3\text{NH}_3 \cdot 3\text{H}_2\text{O}$ . It precipitates 3 moles of  $\text{AgCl}$ . What is the secondary valency of central atom.

- (1) 4      (2) 3      (3) 1      (4) 6

Ans. (4)

Sol.  $[\text{Cr}(\text{NH}_3)_3(\text{H}_2\text{O})]\text{Cl}_3 + \text{AgNO}_3 \longrightarrow 3\text{AgCl} \downarrow$   
White ppt.

11. For a process  $\Delta H_{\text{fusion}} = 2.4 \text{ K.Cal mol}^{-1}$  and  $\Delta H_{\text{vaporisation}} = 98.6 \text{ K.Cal mol}^{-1}$ . Then  $\Delta H_{\text{sublimation}}$  (on  $\text{Kcal mol}^{-1}$ ) :

Ans. 101 K.Cal  $\text{mol}^{-1}$

Sol.  $\Delta H_{\text{sublimation}} = \Delta H_{\text{vap}} + \Delta H_{\text{fusion}}$   
 $= 98.6 + 2.4$   
 $= 101 \text{ K.Cal mol}^{-1}$

12. Which of the following statement is correct :

- (1) H–H bond strength is equal to D–D bond strength.  
(2) H–H bond strength is half of D–D bond strength.  
(3) H–H bond strength is double the D–D bond.  
(4) H–H bond strength is less than D–D bond strength

Ans. (4)

Sol. H–H bond denunciation energy 435 KJ/mol  
D–D bond denunciation energy 450 KJ/mol

13. Which of the following about micelle formation is correct for sodium stearate  $[\text{C}_{17}\text{H}_{35}\text{COO-Na}^+]$

- (1) Micelles formed are spherical with hydrocarbon part towards the centre of sphere  
(2) Micelles formed are spherical with hydrocarbon part lying outside  
(3) Micelles formed are Non spherical with hydrocarbon part towards the centre of sphere  
(4) Micelles formed are Non-spherical with hydrocarbon part lying outside

Ans. (1)

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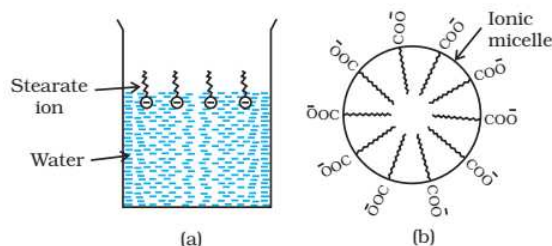
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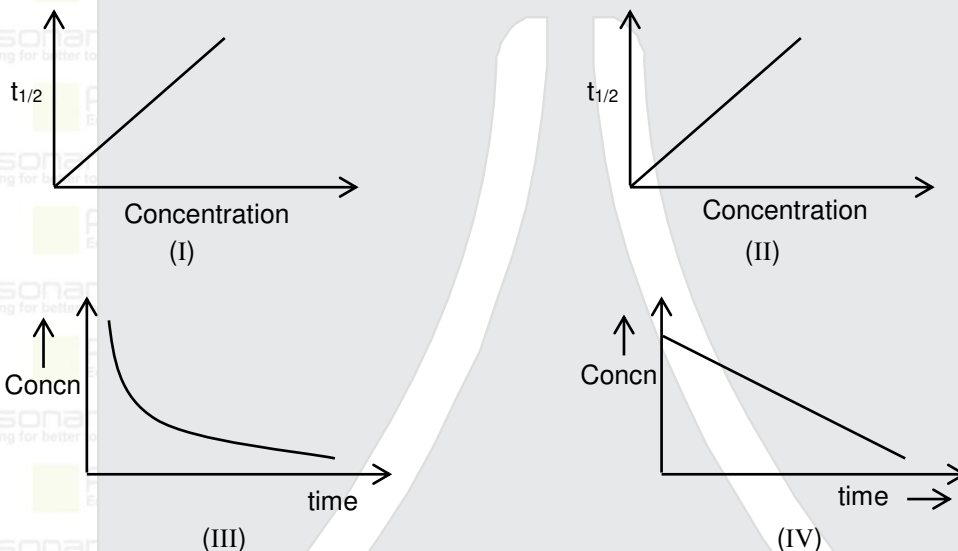
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Sol.



14. From the graphs given below. Select the correct statements.



- (1) I, III – First order ; II, IV – Zero order  
(2) I, IV – zero order ; II, III – First order  
(3) I, II – zero order ; III, IV – First order  
(4) I, IV – First order ; II, IV – zero order

Ans. (2)

Sol.  $A_t = (A_0) - Kt$  : Zero Oder

$$t_{1/2} = \left( \frac{A_0}{2K} \right)$$

$A = A_0 e^{-Kt}$  ; First oder

$$t_{1/2} = \frac{\ln 2}{K}$$

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15. Which of the following protein is soluble in water?

- (1) Albumin (2) Fibrin (3) myosin (4) Collagen

Ans. (1)

Sol. It is globular protein (water soluble)

16. Which of the following is not used for drying agent?

- (1)  $\text{Cl}_2\text{C} = \text{CCl}_2$  (2) Liquid  $\text{CO}_2$  (3)  $\text{H}_2\text{O}_2$  (4)  $\text{CCl}_4$

Ans. (1)

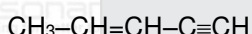
17.  $\text{CH}_3\text{MgBr}$  react which of the following to give methane gas?

- (1)  $\text{H}_2\text{S}$  (2)  $\text{H}_2\text{O}$  (3)  $\text{NH}_3$  (4) All of these

Ans. (4)

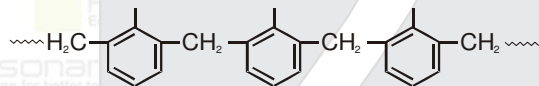
Sol. Grignard reagent act as strong base.

18. Number of  $\sigma$  bonds



Ans. (10)

19. Given structure is

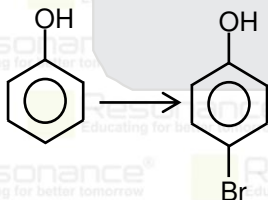


- (1) Buna-N (2) Bakelite (3) Novolac (4) Styrene

Ans. (3)

Sol. Novolac is linear polymer.

20.



- (i)  $\text{Br}_2/\text{H}_2\text{O}$  (ii)  $\text{Br}_2/\text{FeBr}_3$  (iii)  $\text{Br}_2/\text{CS}_2$  (iv)  $\text{Br}_2/\text{CHCl}_3$   
 (1) (i) & (ii) (2) (ii) & (iii) (3) (iii) & (iv) (4) (i) & (iv)

Ans. (3)

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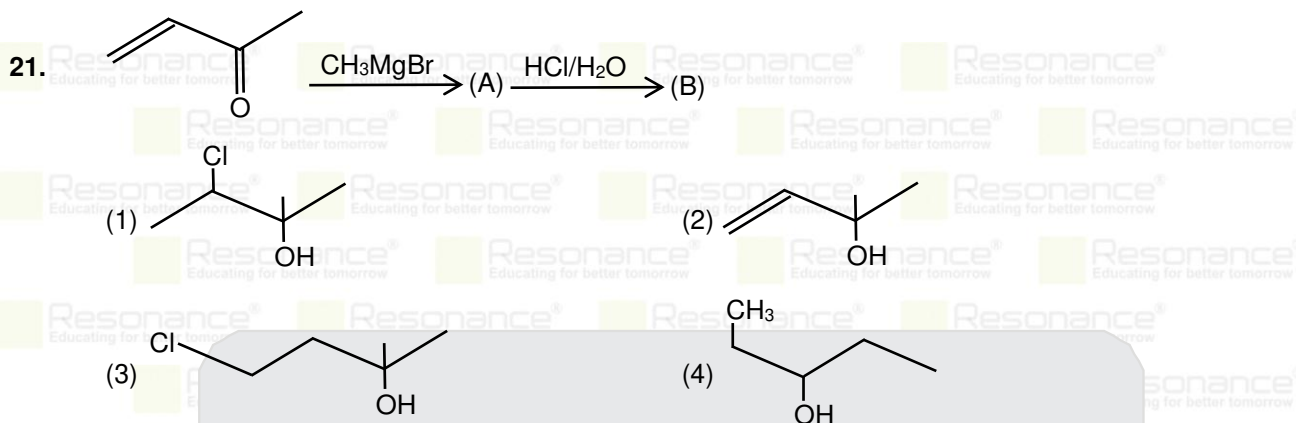
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Ans. (2)

22. **Assertion:** Primary aromatic amine can't be prepared by Gabriel-phthalimide method.

**Reason:** Aryl halide cannot undergo nucleophilic substitution reaction.

(1) Assertion-1 is True, Reason-2 is True; Reason-2 is a correct explanation for Assertion-1.

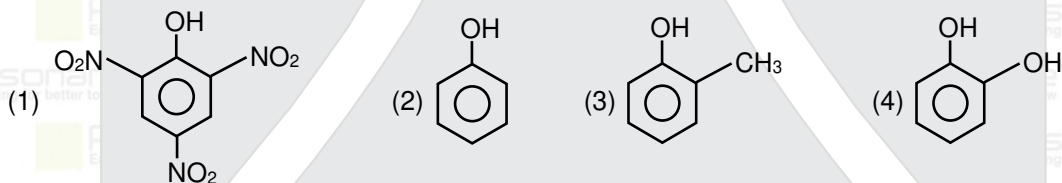
(2) Assertion-1 is True, Reason-2 is True; Reason-2 is NOT a correct explanation for Assertion-1.

(3) Assertion-1 is True, Reason-2 is False.

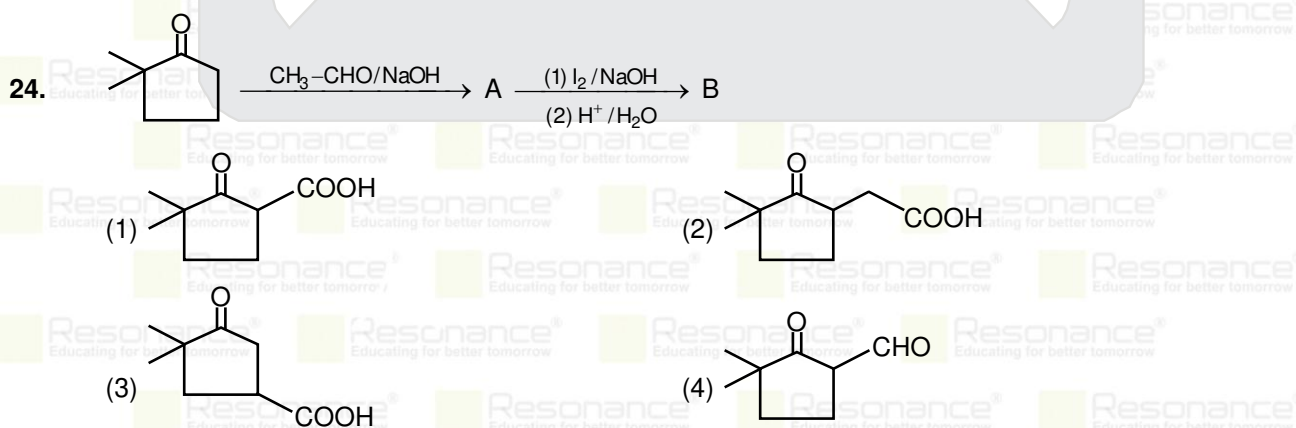
(4) Assertion-1 is False, Reason-2 is True.

Ans. (1)

23. Which of the following react with  $\text{NaHCO}_3$  and evolved  $\text{CO}_2$  gas.



Ans. (1)



Ans. (1)

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