VIDYAPEETH ACADEMY
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IIT JEE | NEET | OLYMPIAD | KVPY | NTSE

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

JEE (Main) 2021

Questions & solutions

(Reproduced from memory retention)

Date : 24 February, 2021 (SHIFT-1) Time ; (9.00 am to 12.00 pm)

Duration : 3 Hours | Max. Marks : 300

SUBJECT : CHEMISTRY

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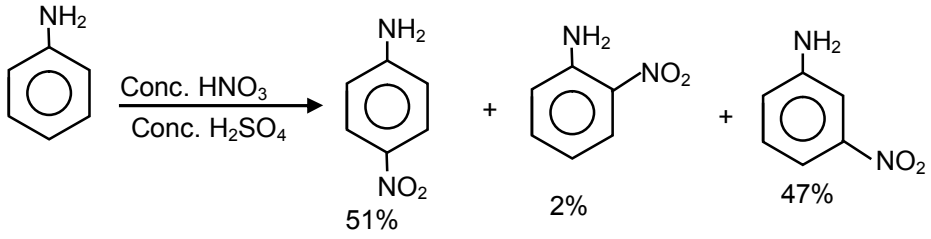
CHEMISTRY

1. What is the reason for the formation of meta product in the following reaction?



(1) Aniline is ortho/para directing

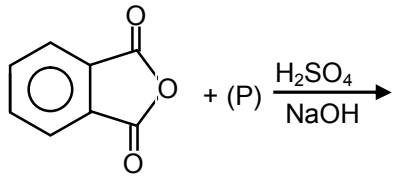
(2) Aniline is meta directing

(3) In acidic medium, aniline is converted into anilinium ion which is ortho/para directing

(4) In acidic medium, aniline is converted into anilinium ion which is meta directing

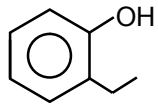
Ans. **(4)**

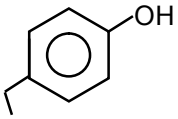
Sol. In acidic medium, aniline is converted into anilinium ion which is meta directing

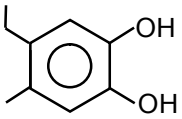
2. 

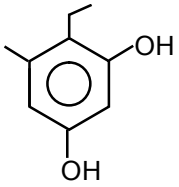
Pink colour

Missing reagent (P) is

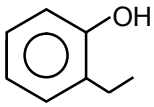
(1) 

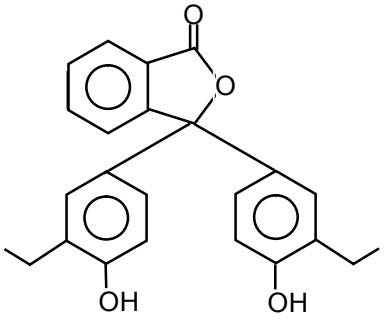
(2) 

(3) 

(4) 

Ans. **(1)**

Sol. P is 



3. Which force is responsible for the stacking of α-helix structure of protein?

(1) H-bonding (2) Ionic bonding (3) Covalent bond (4) Vanderwal forces

Ans. **(1)**

Sol. Hydrogen bond is responsible for the stacking of α-helix structure of protein.

4. The gas evolved due to anaerobic degradation of vegetation causes?

(1) Global warming and caner

(2) Acid rain

(3) Ozone hole

(4) Metal corrosion

Ans. **(1)**

Sol. The gas CH_4 evolved due to anaerobic degradation of vegetation which causes global warming and caner.

5. Match the column

(i) Caprolactum	(a) Neoprene
(ii) Acrylo nitrile	(b) Buna N
(iii) 2-chlorobuta-1,3-diene	(c) Nyolon-6
(iv) 2-Methylbuta-1,3-diene	(d) Natural rubber

(1) (i) → (b), (ii) → (c), (iii) → (a), (iv) → (d)

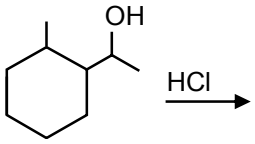
(2) (i) → (a), (ii) → (c), (iii) → (b), (iv) → (d)

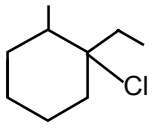
(3*) (i) → (c), (ii) → (b), (iii) → (a), (iv) → (d)

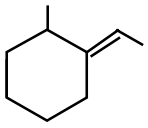
(4) (i) → (c), (ii) → (a), (iii) → (b), (iv) → (d)

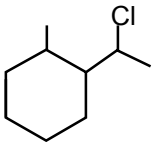
Ans. **(3)**

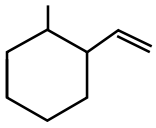
6. What is the major product of the following reaction?



(1) 

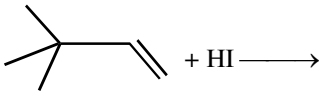
(2) 

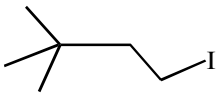
(3) 

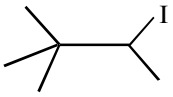
(4) 

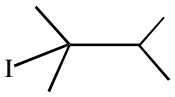
Ans. **(1)**

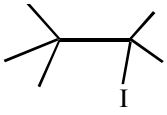
7. What is the major product of following reaction?



(1) 

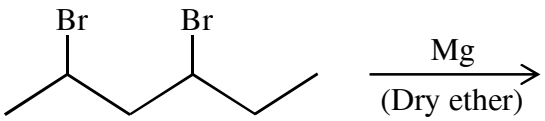
(2) 

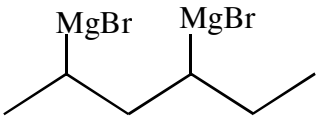
(3) 

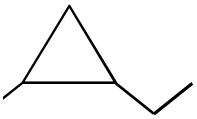
(4) 

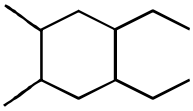
Ans. **(3)**

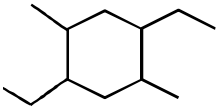
8. Identify the major product?



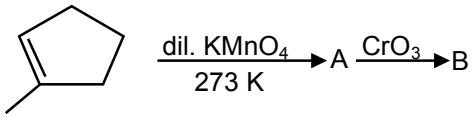
(1) 

(2) 

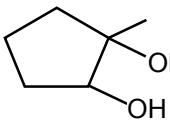
(3) 

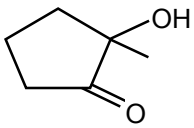
(4) 

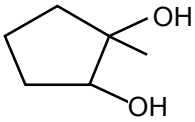
Ans. **(2)**

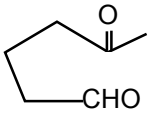
9. 

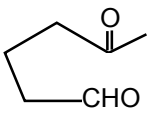
Product A and B are ?

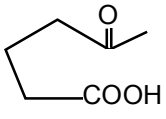
(1) A = 

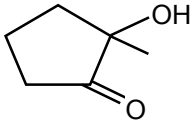
B = 

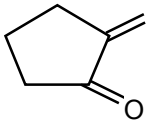
(2) A = 

B = 

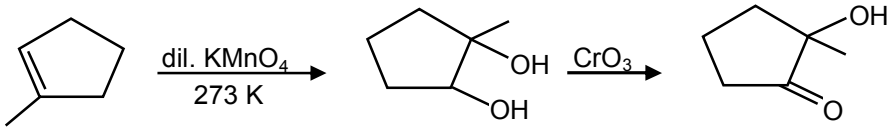
(3) A = 

B = 

(4) A = 

B = 

Ans. (1)

Sol. 

10. $CH_3–CH_2–CH_3 \xrightarrow{(A)} CH_3–CH_2–\overset{O}{\overset{\|}{C}}–H$

Which reagent (A) is used for following given conversion?

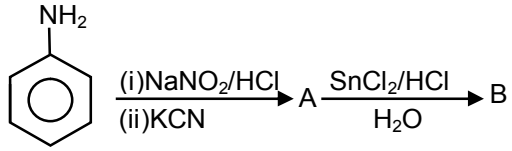
(1) Cu/Δ/ high pressure

(2) Molybdenum oxide

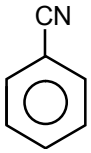
(3) Manganese acetate

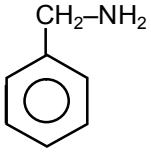
(4) Potassium permanganate

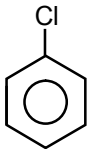
Ans. **(2)**

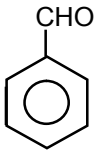
11. 

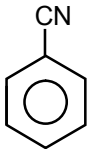
Find A and B

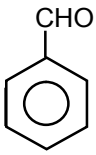
(1) A = 

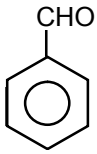
B = 

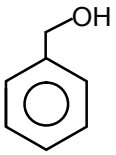
(2) A = 

B = 

(3) A = 

B = 

(4) A = 

B = 

Ans. **(3)**

12. Which of the following have both the compound isostructural.

(A) $TiCl_4$, $SiCl_4$ (B) SO_4^{2-}, CrO_4^{2-} (C) NH_3, NO_3^- (D) ClF_3, BCl_3

(1) A,B (2) A,C (3) B,C (4) A,D

Ans. **(1)**

13. Which of the following ores are concentrated by cyanide of group I^{st} element.

(1) Sphalerite (2) Malachite (3) Calamine (4) Siderite

Ans. **(1)**

14. S-1: Colourless cupric metaborate is converted into cuprous metaborate in luminous flame.

S-2: Cuprous metaborate is formed by reacting copper sulphate with boric anhydride heated in non luminous flame.

(1) S_1 is true and S_2 is false (2) S_1 is flase and S_2 is true

(3) Both are false (4) Both are true.

Ans. **(3)**

15. (1) $I_2 + H_2O_2 + 2OH^- \longrightarrow 2I^- + 2H_2O + O_2$

(2) $H_2O_2 + HOCl \longrightarrow Cl^- + H_3O^+ + O_2$

(1) H_2O_2 is acting as oxidising agent in both the reaction

(2) H_2O_2 is acting as reducing agent in both the reaction

(3) H_2O_2 is acting as oxidising agent in reaction (1) and as reducing agent in reaction(2)

(4) H_2O_2 is acting as reducing agent in reaction (1) and as oxidising agent in reaction (2)

Ans. **(2)**

16. $E^{o}_{M^{2+}/M}$ has positive value for which of the element of 3d transition series.

Ans. (Cu)

17. $Al + NaOH \longrightarrow X \xrightarrow{Y_{(g)}} Z$

Identify X,Y,Z in the above reaction sequence

(1) X = $Na[Al(OH)_4$ Y = CO_2 Z = Al_2O_3. x H_2O

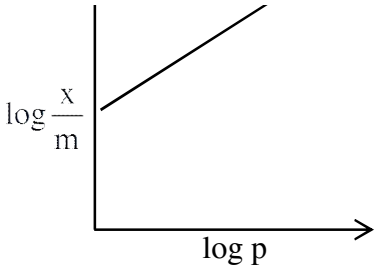
(2) X = $Na[Al(OH)_4$ Y = SO_2 Z = Al_2O_3. x H_2O

(3) X = $Al(OH)_3$ Y = CO_2 Z = Al_2O_3

(4) $Al(OH)_3$ Y = SO_2 Z = Al_2O_3

Ans. **(1)**

18. The slope of the straight line given in the following diagram for adsorption is



(1) $\frac{1}{n}$ (0 to 1) (2) $\frac{1}{n}$ (0.1 to 0.5) (3) log n (4) log $\frac{1}{n}$

Ans. **(1)**

Sol. Slope = $\frac{1}{n}$ (0 to 1)

19. Composition of gun metal is

(1) Cu, Zn, Sn (2) Al, Mg, Mn, Cu

(3) Cu, Ni, Fe (4) Cu, Sn, Fe

Ans. **(1)**

20. Arrange the following in the correct order of ionisation potential

Mg, Al, Si, P, S

Ans. Al < Mg < Si < S < P

Sol. Theory

21. $Cl_{2_{(g)}} \rightleftharpoons 2Cl_{(g)}$

For the given reaction at equilibrium moles of $Cl_{2(g)}$ is equal to the moles of $Cl_{(g)}$ and equilibrium pressure is 1atm. if K_p of this reaction is $x \times 10^{-1}$. Find x

Ans. **(5)**

Sol. $Cl_2 \rightleftharpoons 2Cl$

Moles x x

at eq^n

P.P. $\frac{1}{2}$ $\frac{1}{2}$

$$K_P = \frac{P_{Cl}^2}{P_{Cl_2}}$$

$$= \frac{\left(\frac{1}{2}\right)^2}{\frac{1}{2}} = \frac{1}{2} = 0.5$$

$$= 5 \times 10^{-1}$$

$x = 5$

22. $S_8 + b\,OH^- \longrightarrow c\,S^{2-} + d\,S_2O_3^{2-} + H_2O$

Find the value of c.

Ans. **(4)**

Sol. $S_8 + 12\,OH^- \longrightarrow 4S^{2-} + 2S_2O_3^{2-} + 6H_2O$

23. Calculate time taken in seconds for 40% completion of first order reaction if rate constant is 3.3×10^{-4} sec^{-1}.

Ans. 1535.3

Sol. $$t = \frac{2.303}{K}\log\frac{100}{100-x}$$

$$= \frac{2.303}{3.3\times10^{-4}}\log\frac{100}{100-40}$$

$$= \frac{2.303}{3.3\times10^{-4}} \times 0.22$$

= 1535.3 sec.

24. For a chemical reaction K_{eq} is 100 at 300K, the value of Δ_rG is $-xR$ Joule at 1 atm pressure. Find the value of x. (Use ln 10 = 2.3)

Ans. 1380

Sol. $\Delta_rG^\circ = -RT\ln K_{eq}$

$= -R \times 300 \times 2 \times 2.3$

$= -1380\ R$

25. $Cu^{2+} + NH_3 \rightleftharpoons [Cu(NH_3)]^{2+}$ $K_1 = 10^4$

$[Cu(NH_3)]^{2+} + NH_3 \rightleftharpoons [Cu(NH_3)_2]^{2+}$ $K_2 = 1.58 \times 10^3$

$[Cu(NH_3)_2]^{2+} + NH_3 \rightleftharpoons [Cu(NH_3)_3]^{2+}$ $K_3 = 5 \times 10^2$

$[Cu(NH_3)_3]^{2+} + NH_3 \rightleftharpoons [Cu(NH_3)_4]^{2+}$ $K_4 = 10^2$

Dissociation constant of $[Cu(NH_3)_4]^{2+}$ is $x \times 10^{-12}$.

Determine x

Ans. 1.26 (Nearest integer = 1)

Sol. $[Cu(NH_3)_4]^{2+} \rightleftharpoons Cu^{2+} + 4NH_3$

$$K = \frac{1}{K_1K_2K_3K_4} = \frac{1}{10^4 \times 1.58 \times 10^3 \times 5 \times 10^2 \times 10^2}$$

$= 1.26 \times 10^{-12} = 1.26$

26. $CH_2ClCOOH$ is dissolved in 500ml of H_2O solution and depression in freezing point of solution is 0.5°C

Find percentage dissociation .

$\left(K_f\right)_{H_2O} = 1.86\ k\ kg\ mole^{-1}$

Ans. **(7.5)**

Sol. $\Delta T_f = i \times K_f \times m$

$$0.5 = (1+\alpha) \times 1.86 \times \frac{9.45 \times 1000}{94.5 \times 500}$$

$\Rightarrow (1+\alpha) = 1.075$

$\Rightarrow \alpha = 0.075$

$\Rightarrow \alpha = 7.5\%$

27. What is the coordination number in Body centered cubic (BCC) arrangement of identical particles

Ans. **8**

Sol. Theory

28. Among the following compounds how many are amphoteric in nature

$Be(OH)_2$, BeO, $Ba(OH)_2$, $Sr(OH)_2$

Ans. **2**

Sol. $Be(OH)_2$, BeO

29. 4.5 gm of solute having molar mass of 90 gm/mol is dissolved in water to make 250 ml solution. Calculate molarity of the solution

Ans. **0.2**

Sol. $M = \frac{n}{V} = \frac{4.5/90}{250/1000} = 0.2$

30. Mass of Li^{3+} is 8.33 times mass of proton Li^{3+} and proton are accelerated through same potential difference. Then ratio of debroglie's wavelength of Li^{3+} to proton is $x \times 10^{-1}$. Find x

Ans. **2**

Sol. $\lambda_{DB} \alpha \frac{1}{\sqrt{m.K.E.}}$

$$\frac{\lambda_{Li^{3+}}}{\lambda_P} = \sqrt{\frac{m_p \times e_p V}{8.33 m_p \times 3 e_p V}}$$

$$\sqrt{\frac{1}{25}} = \frac{1}{5} = 0.2 = 2 \times 10^{-1}$$