



# JEE (Main)

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

# 2022

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

Date: 23 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 Most stable trihalide from  $\text{NF}_3$ ,  $\text{NBr}_3$ ,  $\text{NCl}_3$ , &  $\text{NI}_3$  is

(1)  $\text{NF}_3$

(2)  $\text{NCl}_3$

(3)  $\text{NCl}_3$

(4)  $\text{NI}_3$

Ans. (1)

Sol.  $\text{NF}_3$  is stable while  $\text{NCl}_3$ ,  $\text{NBr}_3$ ,  $\text{NI}_3$  are explosive

- 2 Atom 'X' arranged in HCP unit cell while Y atom occupy  $\frac{2}{3}$  tetrahedral voids then % of X in unit cell.

[Report your answer to nearest integer]

Ans. (43)

Sol.  $X = 6[\text{HCP unit cell}]$

$$Y = \frac{2}{3} \times [\text{TV}] = \frac{2}{3} \times 12 = 8$$

$$\text{Formula} = X_6Y_8 \Rightarrow X_3Y_4$$

$$\begin{aligned} \% \text{ of } x \text{ in unit cell} &= \frac{3}{7} \times 100 \\ &= 42.857 \approx 43 \end{aligned}$$

- 3 which set of quantum number represent degenerate orbital

$$(a) n = 3, \ell = 2, m = 0, s = -\frac{1}{2} \text{ \& } n = 3, \ell = 2, m = -1, s = +\frac{1}{2}$$

$$(b) n = 2, \ell = 1, m = 1, s = -\frac{1}{2} \text{ \& } n = 3, \ell = 1, m = 1, s = +\frac{1}{2}$$

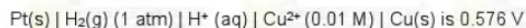
$$(c) n = 4, \ell = 2, m = -1, s = \frac{1}{2} \text{ \& } n = 3, \ell = 2, m = -1, s = \frac{1}{2}$$

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

Ans. (1)

Sol. The orbitals with same n &  $\ell$  value but with different m value are degenerate

4. Emf of the following cell



is 0.576 V

$$\text{then find pH of anodic half-cell given}$$

$$E_{\text{Cu}^{2+}/\text{Cu}}^{\circ} = 0.34 \text{ V \& } \frac{2.303RT}{F} = 0.06$$

[Report your answer to nearest integer]





Ans. (5)

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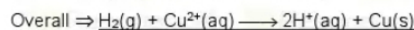
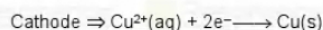
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Sol. Anode  $\Rightarrow \text{H}_2(\text{g}) \longrightarrow 2\text{H}^+(\text{aq}) + 2\text{e}^-$



$$E_{\text{cell}}^{\circ} = E_{\text{Cu}^{2+}/\text{Cu}}^{\circ} - E_{\text{H}^+/\text{H}_2}^{\circ} = 0.34 \text{ V}$$

$$E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{0.06}{2} \log \frac{[\text{H}^+]^2}{[\text{Cu}^{2+}]}$$

$$0.576 = 0.34 + 0.03 [-\log[\text{H}^+]^2 + \log[\text{Cu}^{2+}]]$$

$$0.576 = 0.34 + 0.03 [2\text{pH} + \log[\text{Cu}^{2+}]]$$

$$0.236 = 0.03 [2\text{pH} - 2]$$

$$7.866 = 2\text{pH} - 2$$

$$\text{pH} = 4.93 \approx 5$$

5.  $\text{C}_{15}\text{H}_{30}$  is used as rocket fuel then find mass of oxygen used for per lit consumption of  $\text{C}_{15}\text{H}_{30}$  also find mass of  $\text{CO}_2$  produced. Given density of  $\text{C}_{15}\text{H}_{30} = 0.756 \text{ gram/ml}$

(1) 2592 gram, 2376 gram

(2) 2376 gram, 2592 gram

(3) 2592 gram, 2868 gram

(4) 2868 gram, 2776 gram

Ans. (1)

Sol. density =  $\frac{\text{mass}}{\text{volume}}$

volume  
 mass of  $C_{15}H_{30} = d \times V = 0.756 \times 1000 = 756 \text{ gram}$   

$$C_{15}H_{30}(l) + \frac{45}{2} O_2(g) \longrightarrow 15CO_2(g) + 15H_2O$$
  

$$\frac{756}{210} \quad \frac{45}{2} \left[ \frac{756}{210} \right] \text{mole} \quad 15 \left[ \frac{756}{210} \right]$$
  

$$W_{O_2} = \frac{45}{2} \left[ \frac{756}{210} \right] 32 = 2592 \text{ gram}$$
  

$$W_{CO_2} = 2376 \text{ gram}$$

6. What is concentration of a glucose solution in interavenous injection in gram/lit which is isotonic with Blood solution which has osmotic pressure 7.93 bar at 300 K.

[Report your answer to nearest integer]

Ans. (58)

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Sol. For isotonic solution

$$\pi_{\text{Injection}} = \pi_{\text{Blood}}$$

$$(CRT) = 7.93$$

$$C \times 0.082 \times 300 = 7.93$$

$$C = 0.322 \text{ mole/lit}$$

$$= 0.322 \times 180 = 58 \text{ gram/lit}$$

7 Which ion is not present in teeth enamel

- (1)  $Ca^{2+}$  (2)  $F^{-}$  (3)  $P^{3+}$  (4)  $P^{5+}$

Ans. (3)

Sol. Calcium and phosphate are the major component of hydroxyapatite crystal that form the inorganic portion of the teeth

8 How many of the following oxides are amphoteric in nature?

- (a)  $Na_2O$  (b)  $As_2O_3$  (c)  $NO$   
 (d)  $N_2O$  (e)  $Cl_2O_7$   
 (1) 0 (2) 1 (3) 2 (4) 3

Ans. (2)

Sol. Acidic  $\Rightarrow Cl_2O_7$

Basic  $\Rightarrow Na_2O$

Amphoteric  $\Rightarrow As_2O_3$

Neutral  $\Rightarrow NO, N_2O$

9. A cation  $Y^{2+}$  on reaction with reagent X form Red colour complex then cation  $Y^{2+}$  and reagent X are respectively :

- (1)  $Ni^{2+}$ , ammonical solution of dimethylglyoxime  
 (2)  $Cu^{2+}$ ,  $K_4[Fe(CN)_6]$   
 (3)  $Fe^{3+}$ ,  $K_4[Fe(CN)_6]$   
 (4)  $Zn^{2+}$ ,  $NH_3(aq)$  (excess)

Ans. (1)

Sol.  $Ni^{2+} + dmgo \xrightarrow{\text{Ammonical solution}} [Ni(dmgo)_2] \downarrow$

10. Which is used for commercial production of dihydrogen.

- (1) Carbon (2) Oxygen (3) Chlorine (4) Nitrogen

Ans. (1)

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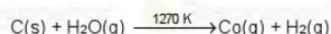
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Sol. Reaction of steam on coke at high temperature in presence of catalyst yield hydrogen



11. Match the Column.

	Column I		Column II
	Compound		Hybridisation
(i)	$\text{PCl}_5$	(a)	$\text{SP}^3\text{d}^2$
(ii)	$[\text{Pt}(\text{CN})_4]^{2+}$	(b)	$\text{SP}^3\text{d}$
(iii)	$[\text{Co}(\text{NH}_3)_6]^{3+}$	(c)	$\text{d}^2\text{SP}^3$
(iv)	$\text{BrF}_5$	(d)	$\text{dSP}^2$

Correct matching is :

	I	II	III	IV		I	II	III	IV
(1)	b	d	c	a	(2)	a	b	c	d
(3)	b	d	a	c	(4)	d	b	a	c

Ans. (1)

Sol.

	Compound		Hybridisation
(1)	$\text{PCl}_5$	(a)	$\text{SP}^3\text{d}$
(2)	$[\text{Pt}(\text{CN})_4]^{2+}$	(b)	$\text{dSP}^2$
(3)	$[\text{Co}(\text{NH}_3)_6]^{3+}$	(c)	$\text{d}^2\text{SP}^3$
(4)	$\text{BrF}_5$	(d)	$\text{SP}^3\text{d}^2$

12. An  $\text{Co}_2(\text{CO})_8$

no. of Co-Co bonds = X

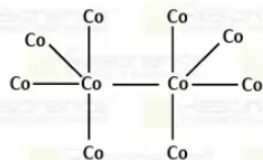
Terminal Co-CO bonds = Y

then (X+Y) is \_\_\_\_\_.

Ans. (9)

Sol.

$\text{Co}_2(\text{CO})_8$



No. of Co - Co bond = X = 1

No. of Co - Co bond = Y = 8

X + Y = 9

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13 Match the List,

	List I		List II
(i)	Calamine	(a)	ZnS
(ii)	Sphalerite	(b)	ZnCO <sub>3</sub>
(iii)	Galena	(c)	PbS
(iv)	Siderite	(d)	FeCO <sub>3</sub>

Identify correct match :

	I	II	III	IV		I	II	III	IV
(1)	a	b	c	d	(2)	b	a	c	d
(3)	b	a	d	c	(4)	d	c	b	a

Ans. (2)

Sol.

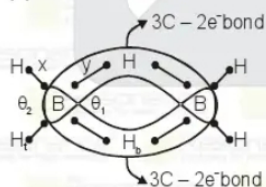
Calamine	ZnCO <sub>3</sub>
Sphalerite	ZnS
Galena	PbS
Siderite	FeCO <sub>3</sub>

14. Among the following statements correct set of statements is.

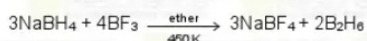
- (a) B<sub>2</sub>H<sub>6</sub> is Lewis acid  
 (b) B<sub>2</sub>H<sub>6</sub> has planar structure  
 (c) All B-H Bond lengths are equal in B<sub>2</sub>H<sub>6</sub>  
 (d) In B<sub>2</sub>H<sub>6</sub> four 3C-2e<sup>-</sup> bonds are present  
 (e) B<sub>2</sub>H<sub>6</sub> can be prepared by reaction of BF<sub>3</sub> and NaBH<sub>4</sub>
- (1) a, b, c, d, e      (2) a, e      (3) a, b      (4) d, e

Ans. (2)

Sol.



B<sub>2</sub>H<sub>6</sub> have 4 2c-2e bonds and 2 3c-2e bonds. Bridging bonds have larger bond length than terminal bonds. Angle between terminal bonds is more than angle between bridging bonds if all 4 terminal bonds are in one plane then bridging bonds are in perpendicular plane.



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15 S<sub>1</sub> : In emulsion oil in water get separated in two different layers.

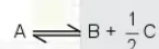
S<sub>2</sub> : It can be stabilized by adding excess of electrolyte.

- (1) S<sub>1</sub> is true and S<sub>2</sub> is false  
 (2) Both statements are true  
 (3) Both statements are false  
 (4) S<sub>1</sub> is false and S<sub>2</sub> is true

Ans. (1)

**Sol.** Emulsions of oil in water are unstable and sometimes they separate into two layers on standing. For stabilisation of an emulsion, a third component called emulsifying agent is usually added

**16** For a equilibrium reaction

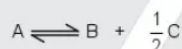


correct relation between degree of dissociation equilibrium pressure and equilibrium constant is :

(1)  $\frac{\sqrt{2}(\alpha)^{\frac{3}{2}}P^{\frac{1}{2}}}{(1-\alpha)(2+\alpha)^{\frac{1}{2}}}$  (2)  $\frac{\sqrt{2}(\alpha)P}{(1-\alpha)(2+\alpha)}$  (3)  $\frac{\sqrt{2}(\alpha)P^{\frac{1}{2}}}{(1-\alpha)(2+\alpha)^{\frac{1}{2}}}$  (4)  $\frac{2\alpha P}{(1-\alpha)(2+\alpha)}$

**Ans.** (1)

**Sol.**



Initially      1      0      0  
 (1-α)      α       $\frac{\alpha}{2}$

$$n_{\text{Total}} = \left(1 + \frac{\alpha}{2}\right)$$

$$K_p = \frac{\left[\frac{\alpha P}{1 + \frac{\alpha}{2}}\right] \left[\left(\frac{\alpha}{1 + \frac{\alpha}{2}}\right) P\right]^{\frac{1}{2}}}{\left[\frac{1 - \alpha P}{1 + \frac{\alpha}{2}}\right]} = \frac{\left[\frac{2\alpha}{(2+\alpha)} P\right] \left[\frac{2\alpha}{(2+\alpha)} P\right]^{\frac{1}{2}}}{\left[\frac{2(1-\alpha)P}{(2+\alpha)}\right]} = \frac{\alpha}{(1+\alpha)} \times \left(\frac{2\alpha}{(2+\alpha)} \times P\right)^{\frac{1}{2}} = \frac{\sqrt{2}(\alpha)^{\frac{3}{2}}P^{\frac{1}{2}}}{(1-\alpha)(2+\alpha)^{\frac{1}{2}}}$$

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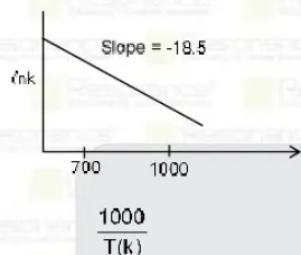
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**17.** For a 1<sup>st</sup> order reaction following graph is obtained between  $\ln k$  and  $\frac{1000}{T}$ . Then activation energy of reaction in kcal is :



**Ans.** (37)

**Sol.**  $k = Ae^{\frac{-E_a}{Rt}}$

$$\ln k = \ln A - \frac{E_a}{R_T}$$

$$\ln k = \ln A + \left[\frac{-E_a}{1000R}\right] \frac{1000}{T}$$

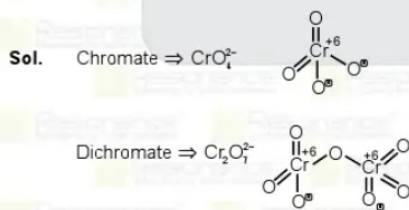
$$\text{Slope} = \frac{-E_a}{1000R} = -18.5$$

$$E_a = 18.5 \times 1000 \times 2$$

$$= 37 \times 10^3 \text{ Cal}$$

$$= 37 \text{ kCal}$$

18. The difference between oxidation state of chromium in chromate & dichromate is –  
 Ans. (0)



19. Which of the following is not a broad spectrum antibiotic  
 (1\*) Penicillin G (2) Ofloxacin (3) Amoxicillin (4) Chloramphenicol  
 Ans. (1)

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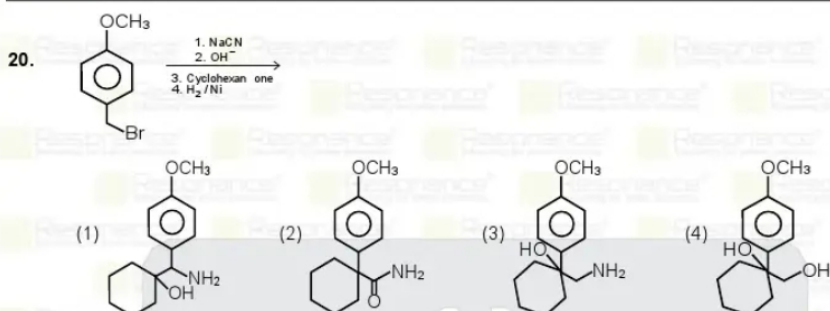
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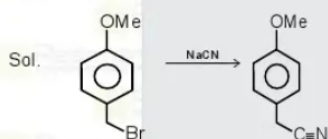
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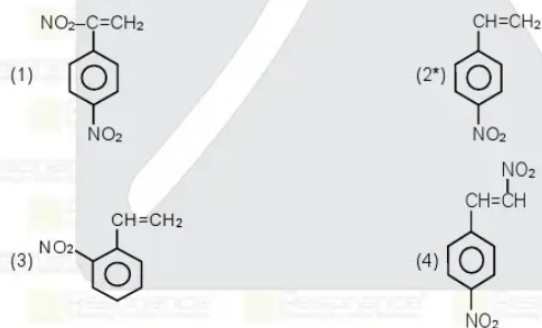
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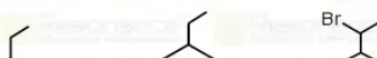
Ans. (1)

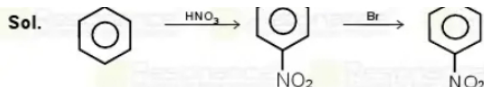


21.  $\text{C}_8\text{H}_{10} \xrightarrow[\text{H}_2\text{SO}_4]{\text{HNO}_3} \text{A} \xrightarrow[\Delta]{\text{Br}_2} \text{B} \xrightarrow[\text{KOH}]{\text{alcoholic}} \text{C}$   
 What is major product C.



Ans. (2)





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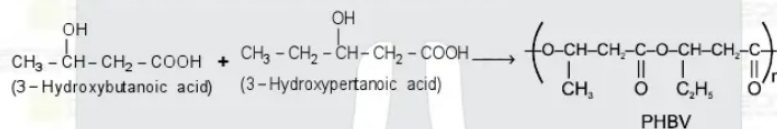
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22. Which of following will form polyester

- (1)  $\beta$ -Hydroxy butanoic acid &  $\beta$ -hydroxy pentanoic acid
- (2) Butadiene & styrene
- (3) Neoprene
- (4) Melamine formaldehyde

Ans. (1)

Sol. Poly  $\beta$ -hydroxybutyrate-co- $\beta$ -hydroxy valerate (PHBV) : It is obtained by the copolymerisation of 3-hydroxybutanoic acid and 3-hydroxypentanoic acid.



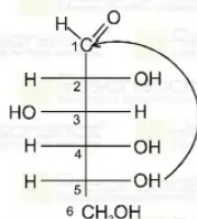
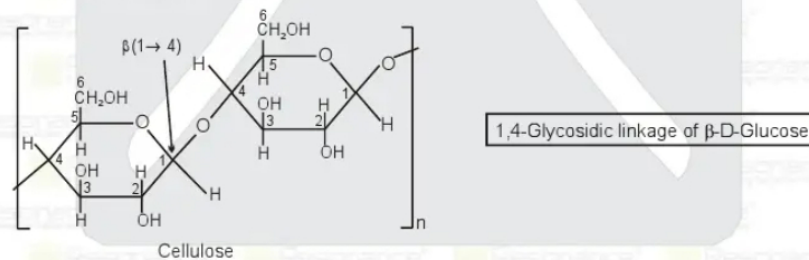
PHBV is used in speciality packaging, orthopaedic devices and in controlled release of drugs. PHBV undergoes bacterial degradation in the environment.

23. Compound 'A' hydrolysis gives compound 'B' which on reaction with  $\text{Br}_2$  water to form gluconic acid. 'A' originally has  $\beta$ -glycosidic linkages. Which of the following is compound A

- (1) Starch
- (2) Cellulose
- (3) Amylose
- (4) Amylopectin

Ans. (2)

Sol. Cellulose,  $(\text{C}_6\text{H}_{10}\text{O}_5)_n$



D-Glucose  
Specific rotation  $(+52.7^\circ)$

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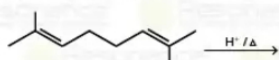
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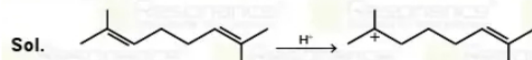


24. 2, 7 Dimethyl 2,6 Octadiene  $\xrightarrow{O/\Delta}$

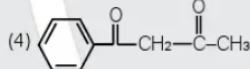
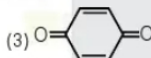
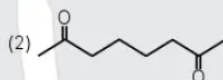
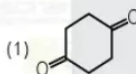


Number of  $sp^2$  carbon present in product :

Ans. (2)



25. Which of the following is conjugated diketone



Ans. (3)

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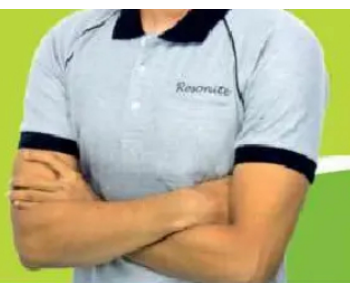


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