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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 NF_3 , NBr_3 , NCl_3 , & NI_3 is
(1) NF_3 (2) NCl_3 (3) NCl_3 (4) NI_3

Ans. (1)

Sol. NF_3 is stable while NCl_3 , NBr_3 , 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. $X = 6$ [HCP unit cell]

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

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

$$\begin{aligned} \text{\% of } x \text{ in unit cell} &= \frac{3}{7} \times 10 \\ &= 42.857 \approx 43 \end{aligned}$$

3 which set of quantum number represent degenerate orbital

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

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

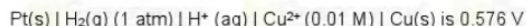
(c) $n = 4, \ell = 2, m = -1, s = \frac{1}{2}$ & $n = 3, \ell = 2, m = -1, s = \frac{1}{2}$

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

Ans. (1)

Sol. The orbitals with same n & ℓ value but with different m value are degenerate

4. Emf of the following cell



is 0.576 V

then find pH of anodic half-cell given

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

[Report your answer to nearest integer]

Ans. (5)

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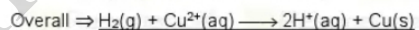
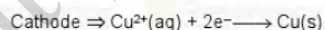
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Sol. Anode $\Rightarrow \text{H}_2(g) \longrightarrow 2\text{H}^+(aq) + 2e^-$



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

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

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

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

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

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

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

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 CO_2 produced. Given density of $\text{C}_{15}\text{H}_{30} = 0.756 \text{ gram/ml}$

(1) 2592 gram, 2376 gram

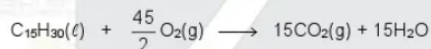
(2) 2376 gram, 2592 gram

(3) 2592 gram, 2868 gram

(4) 2868 gram, 2776 gram

Ans. (1)

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



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

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

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

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 $\Rightarrow Na_2O$

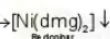
Amphoteric $\Rightarrow As_2O_3$

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)



10. Which is used for commercial production of dihydrogen.
 (1) Carbon (2) Oxygen (3) Chlorine (4) Nitrogen

Ans. (1)

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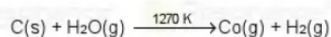
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Sol. Reaction of steam on coke at high temperature in presence of catalyst yield hydrogen



11. Match the Column.

	Column I		Column II
	Compound		Hybridisation
(i)	PCl_5	(a)	sp^3d^2
(ii)	$[Pt(CN)_4]^{2+}$	(b)	sp^3d
(iii)	$[Co(NH_3)_6]^{3+}$	(c)	d^2sp^3
(iv)	BrF_5	(d)	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)

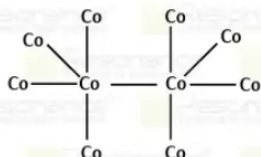
Sol.

	Compound		Hybridisation
(1)	PCl_5	(a)	sp^3d
(2)	$[Pt(CN)_4]^{2+}$	(b)	dsp^2
(3)	$[Co(NH_3)_6]^{3+}$	(c)	d^2sp^3
(4)	BrF_5	(d)	sp^3d^2

12. An $Co_2(CO)_8$
 no. of Co-Co bonds = X
 Terminal Co-CO bonds = Y
 then (X+Y) is _____.

Ans. (9)

Sol. $Co_2(CO)_8$



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)	Sphalarite	(b)	ZnCO ₃
(iii)	Galena	(c)	PbS
(iv)	Siderite	(d)	FeCO ₃

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)

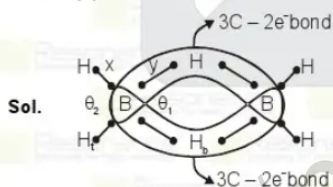
Sol.

Calamine	ZnCO ₃
Sphalarite	ZnS
Galena	PbS
Siderite	FeCO ₃

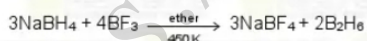
14. Among the following statements correct set of statements is.

- (a) B₂H₆ is Lewis acid
 (b) B₂H₆ has planar structure
 (c) All B-H Bond lengths are equal in B₂H₆
 (d) In B₂H₆ four 3C-2e⁻ bonds are present
 (e) B₂H₆ can be prepared by reaction of BF₃ and NaBH₄
- (1) a, b, c, d, e (2) a, e (3) a, b (4) d, e

Ans. (2)



B₂H₆ 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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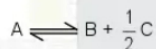
15 S₁ : In emulsion oil in water get separated in two different layers.

S₂ : It can be stabilized by adding excess of electrolyte.

- (1) S₁ is true and S₂ is false
 (2) Both statements are true
 (3) Both statements are false
 (4) S₁ is false and S₂ is true

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

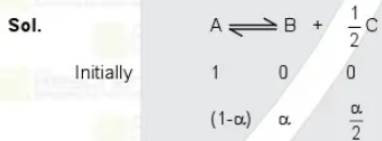
16 For a equilibrium reaction



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)







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

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

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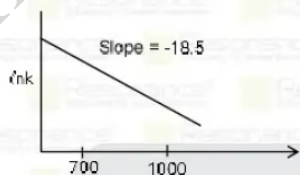
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17. For a 1st order reaction following graph is obtained between $\ln k$ and $\frac{1000}{T}$. Then activation energy of reaction in kcal is :



Ans. (37)

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

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

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

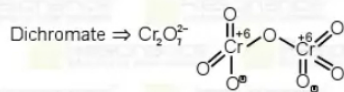
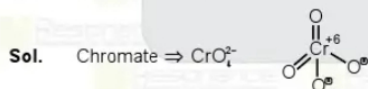
$$E_a = 18.5 \times 1000 \times 2$$

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

$$= 37 \text{ kCal}$$

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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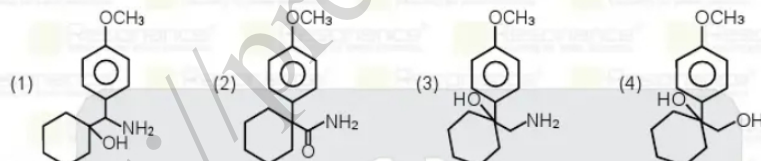
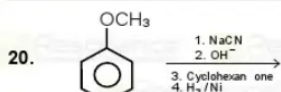
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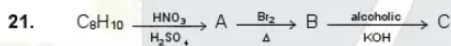
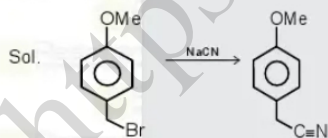
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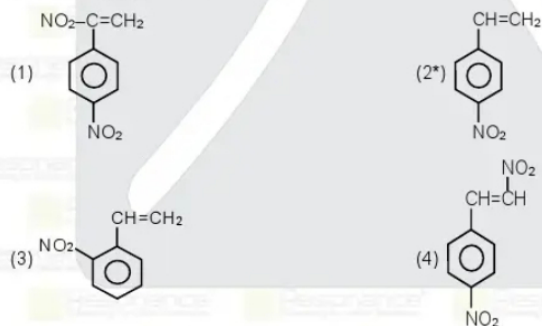
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Ans. (1)

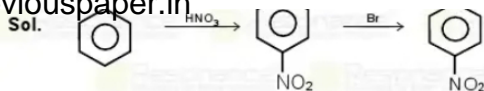


What is major product C.



Ans. (2)





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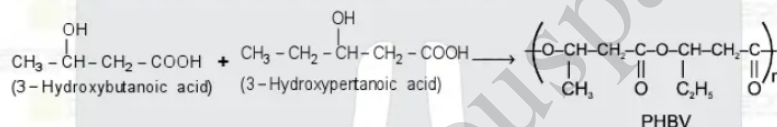
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22. Which of following will form polyester

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

Ans. (1)

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



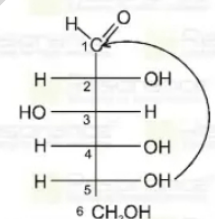
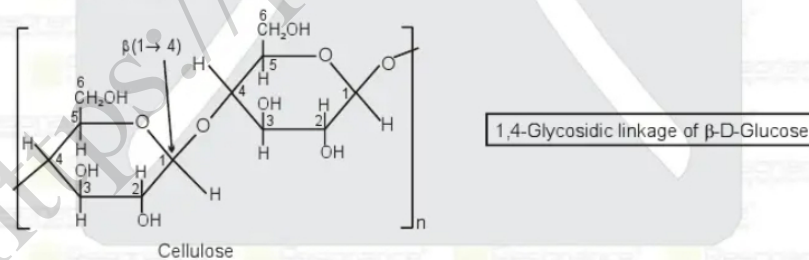
PHBV is used in speciality packaging, orthopaedic devices and in controlled release of drugs. PHBV undergoes bacterial degradation in the environment.

23. Compound 'A' hydrolysis gives compound 'B' which on reaction with Br_2 water to form gluconic acid. 'A' originally has β -glycosidic linkages. Which of the following is compound A

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

Ans. (2)

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



Specific rotation $(+52.7^\circ)$

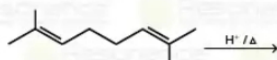
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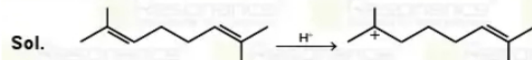
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24. 2, 7 Dimethyl 2,6 Octadiene $\xrightarrow{O/\Delta}$

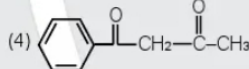
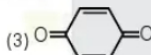
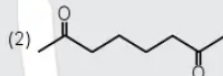
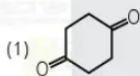


Number of sp^2 carbon present in product :

Ans. (2)



25. Which of the following is conjugated diketone



Ans. (3)

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* T & c Apply