

QUESTIONS & SOLUTIONS

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 12 APRIL, 2023

 9:00 AM to 12:00 Noon

SHIFT - 1

Duration : 3 Hours

Maximum Marks : 300

SUBJECT - CHEMISTRY

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CHEMISTRY

1. How much water (in litre) is added to 1 litre of HCl solution of pH = 1 to make its pH = 2.

Ans. 9 litre

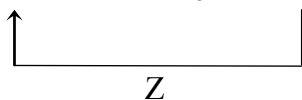
Sol. $M_1V_1 = M_2V_2$

$$0.1 \times 1 = 0.01 \times V_2$$

$$V_2 = 10 \text{ litre}$$

Ans. $10 - 1 = 9$ litre

2. Consider the following reaction sequence



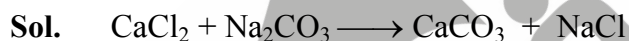
(A) X : CaCO₃, Y : NaCl, Z : HCl

(B) X : CaO, Y : NaCl + CO₂, Z : KCl

(C) X : CaO, Y : NaCl + CO₂, Z : NaCl

(D) X : CaCO₃, Y : NaCl, Z : KCl

Ans. (A)



3. **Complex**

CFSE

(P) [NiF₆]²⁻ (i) $-2\Delta_0$

(Q) [Ti(H₂O)₆]³⁺ (ii) $-2.4\Delta_0$

(R) [Fe(CN)₆]³⁻ (iii) $-0.4 \Delta_0$

(S) [Ni(NH₃)₆]²⁺ (iv) $-1.2 \Delta_0$

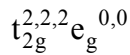
(1) P-(ii) ; Q-(iii) ; R-(i) ; S-(iv)

(2) P-(i) ; Q-(ii) ; R-(iii) ; S-(iv)

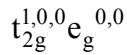
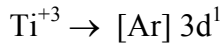
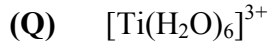
(3) P-(iii) ; Q-(ii) ; R-(iv) ; S-(i)

(4) P-(iv) ; Q-(iii) ; R-(ii) ; S-(i)

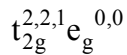
Ans. (1)



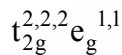
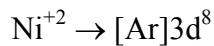
$$\text{CFSE} = -0.4 \times 6\Delta_0 = -2.4\Delta_0$$



$$\text{CFSE} = -0.4 \times 1\Delta_0 = -0.4\Delta_0$$



$$\text{CFSE} = -0.4 \times 5\Delta_0 = -2\Delta_0$$



$$\begin{aligned} \text{CFSE} &= -0.4 \times 6\Delta_0 + 2 \times 0.6\Delta_0 \\ &= -2.4 \Delta_0 + 1.2 \Delta_0 = -1.2\Delta_0 \end{aligned}$$

4.	Column-I	Column-II
	(P) Electron precise	(i) B_2H_6
	(Q) Electron rich	(ii) HF
	(R) Electron deficient	(iii) MgH_2
	(S) Saline Hydride	(iv) CH_4
(1)	P-(iv) Q – (ii) R – (i) S – (iii)	
(2)	P-(ii) Q – (iii) R – (i) S – (iv)	
(3)	P-(iv) Q – (iii) R – (ii) S – (i)	
(4)	P-(ii) Q – (iv) R – (i) S – (iii)	

Ans. (1)

Sol.	Electron precise	CH_4
	Electron rich	HF
	Electron deficient	B_2H_6
	Saline Hydride	MgH_2

5. Statement-1 : $5f e^-$ can participate in bonding to a greater extent as compared to $4f$ electrons.
Statement-2 : Both resemble in their angular part of wave function but $5f$ is not as buried as $4f$ orbitals.
- (1) Both statement-1 and statement-2 are correct and statement-2 is correct explanation of statement-1
(2) Both statement-1 and statement-2 are correct but statement-2 is not correct explanation of statement-1
(3) Statement-1 is correct and statement-2 is incorrect
(4) Statement-1 is incorrect and statement-2 is correct

Ans. (1)

6. C_2^{2-} has same magnetic property and bond order with :

(1) NO^+ (2) O_2^+ (3) N_2^+ (4) O_2

Ans. (1)

Sol. $C_2^{2-} \Rightarrow \sigma 1s^2 \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, [\pi 2p_x^2 = \pi 2p_y^2] \sigma 2p_z^2$

$$B.O. = \frac{10-4}{2} = 3 \quad (\text{Diamagnetic})$$

$NO^+ \Rightarrow$ According N_2 like configuration

(No. of electrons = $7 + 8 - 1 = 14$)

$\sigma 1s^2 \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, [\pi 2p_x^2 = \pi 2p_y^2] \sigma 2p_z^2$

$$B.O. = \frac{10-4}{2} = 3 \quad (\text{Diamagnetic})$$

$O_2^+ \Rightarrow \sigma 1s^2 \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_z^2, [\pi 2p_x^2 = \pi 2p_y^2] [\pi^* 2p_x^1 = \pi^* 2p_y^0]$

(No. of electrons = $16 - 1 = 15$)

$$B.O. = \frac{10-5}{2} = 2.5 \quad (\text{Paramagnetic})$$

7. Light of wavelengths 400 nm is used for photoelectric effect.

Metal	Li	Na	K	Mg	Cu
Work function	2.42	2.3	2.25	3.7	4.8

In how many of the following metals photoelectric is possible ?

Ans. (3)

Sol. (Li, Na, K)

$$E = \frac{1240}{\lambda} = \frac{1240}{400} = 3.1 \text{ eV}$$

Li, Na and K have less work function in comparison of energy of incident light.

So, Li, Na and K can show photoelectric effect but Mg and Cu can not show photoelectric effect.

8. Correct order of density for alkali metal

(1) $\text{Li} < \text{Na} < \text{K} < \text{Rb} < \text{Cs}$

(2) $\text{Li} < \text{K} < \text{Na} < \text{Rb} < \text{Cs}$

(3) $\text{Li} > \text{Na} > \text{K} > \text{Rb} > \text{Cs}$

(4) $\text{Li} > \text{K} > \text{Na} > \text{Rb} > \text{Cs}$

Ans. (2)

Sol. Order of density : $\text{Li} < \text{K} < \text{Na} < \text{Rb} < \text{Cs}$

9. **Statement-1** : Boron is hard as it has high lattice energy.

Statement-2 : Boron has high melting and boiling point as compared to other group members.

(1) Both statements-1 and 2 are correct.

(2) Both statement-1 and 2 are incorrect.

(3) Statement-1 is correct and statement-2 is incorrect.

(4) Statement-1 is incorrect and statement-2 is correct.

Ans. (1)

10. **Statement-1** : SbCl_5 is more covalent than SbCl_3 .

Statement-2 : Higher oxidation state of halogens is more stable.

- (1) Both statements-1 and 2 are correct.
 (2) Both statement-1 and 2 are incorrect.
 (3) Statement-1 is correct and statement-2 is incorrect.
 (4) Statement-1 is incorrect and statement-2 is correct.

Ans. (3)

11. (A) During changing PbSO_4 is converted into PbO_2 at anode.

(B) During changing PbSO_4 is converted into at PbO_2 at cathode.

(C) In lead storage battery ~38% con. H_2SO_4 is used.

Correct statements are:

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

Ans. (3)

12. Most probable speed of gas B at 90K is same as root mean square speed of gas A (Molar mass = 40) at 600K.

Calculate molar mass of gas B.

Ans. 4

Sol.
$$\sqrt{\frac{2R \times T_B}{M_B}} = \sqrt{\frac{3RT_A}{M_A}}$$

$$\frac{2 \times 90}{M_B} = \frac{3 \times 600}{40}$$

$$M_B = 4$$

13. An ideal gas in container with conducting walls is expanded isothermally from 2L to 3L against constant external pressure of 2 atm. Determine work done by the gas in Joule.

Ans. 200 to 203

Sol.
$$W = -P_{\text{ext}}(V_2 - V_1)$$

$$= -2(3 - 2) = -2 \text{ atm-L}$$

$$= -2 \times 101.3$$

$$= -202.6 \text{ J}$$

14. A volatile chloride contains 55% chlorine by weight.
0.57 gm metal chloride vapour occupies 100 ml at STP.

Formula of metal chloride :

- (1) MCl_2 (2) MCl_4 (3) MCl_3 (4) MCl

Ans. (1)

Sol. Molecular mass of metal chloride (MCl_x)

$$= 0.57 \times 227 = 129 = A + 35.5x$$

$$\frac{\text{Mass of Cl}}{\text{Mass of metal}} = \frac{55}{45} = \frac{35.5x}{A}$$

$$A = 29x$$

$$\text{Molecular mass} = A + 35.5x = 127.5$$

$$64.5x = 129$$

$$\Rightarrow x = 2$$

Metal chloride is MCl_2

15. Column-I

(i) Nylon-2, Nylon-6

(ii) Dacron

(iii) PAN

(iv) 2-chlorobuta-1,3-diene

(1) (i)-(d); (ii)-(a); (iii)-(b); (iv)-(c)

Column-II

(a) Polyester

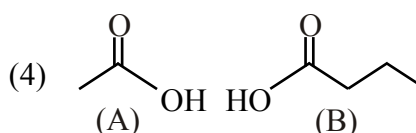
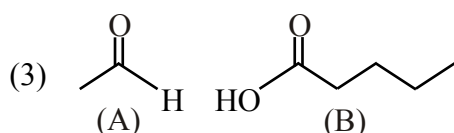
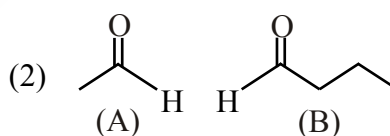
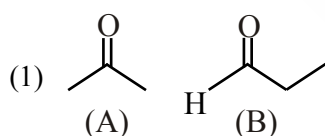
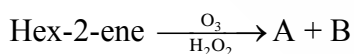
(b) Addition polymer

(c) Synthetic polymer

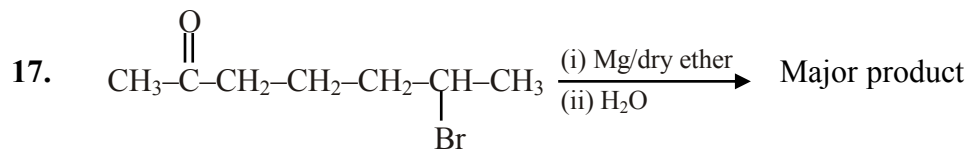
(d) Biodegradable polymer

Ans. (1)

16. Find the products A and B in the given reaction :



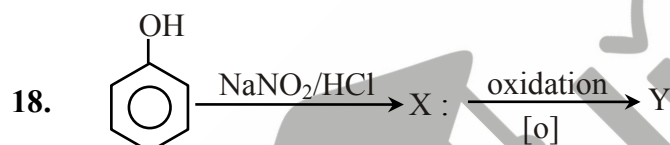
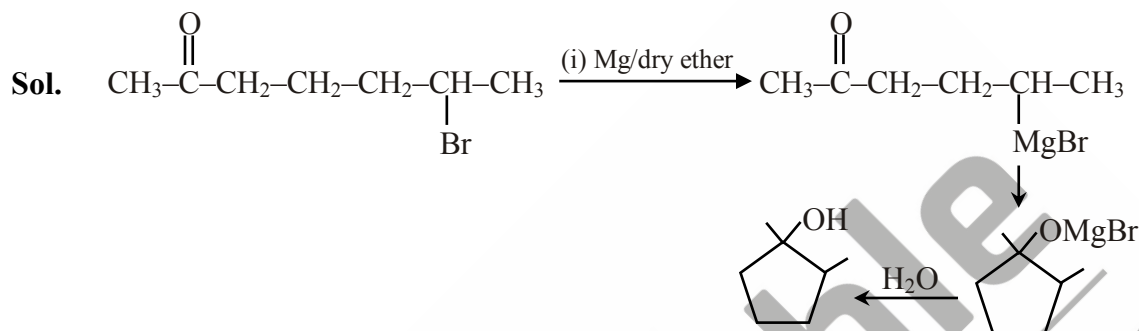
Ans. (4)



Major product is :



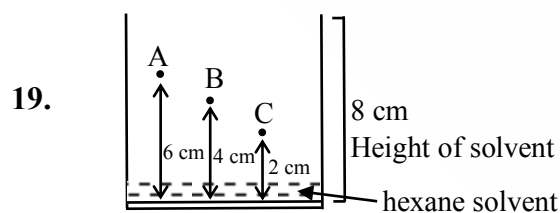
Ans. (1)



Which is incorrect.

- (1) NO^{\oplus} is electrophile (2) X is para nitroso phenol
(3) Y is para nitro phenol (4) x is para nitro phenol

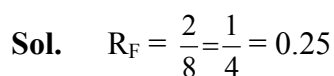
Ans. (4)



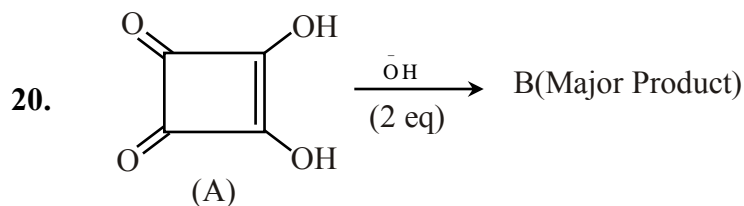
What will be the value of R_F of most polar component

If R_F is $x \times 10^{-2}$. What is x ?

Ans. 25



So, $x = 25$

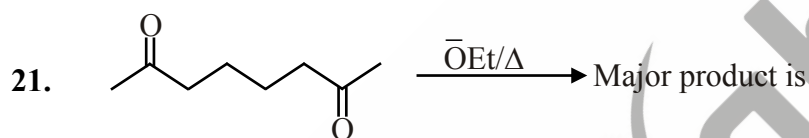


- (i) A show tautomerism
- (ii) B is aromatic
- (iii) All carbon bond length is equal in (B)
- (iv) B is monoanion

Which is/are correct statements :

- (1) (i), (ii), (iii)
- (2) (i), (ii), (iv)
- (3) (ii), (iii), (iv)
- (4) (i) & (iv)

Ans. (1)



Ans. (2)

22. Match the column

Column-I

- (a) Acid rain
- (b) CO₂
- (c) CH₄
- (d) Phosphate fertilizer

Column-II

- (p) Oxide of nitrogen
- (q) Eutrophication
- (r) Global warning
- (s) Rain water at pH 5.6

Ans. (a)-(p); (b)-(s); (c)-(r); (d)-(q)

SATYAM CHAKRAVORTY

(Classroom) →→

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