JEE MAIN JAN'19

QUESTION WITH SOLUTION

DATE : 11-01-2019 _ MORNING

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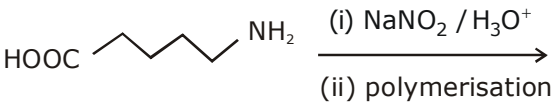
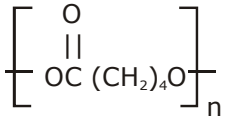
[CHEMISTRY]

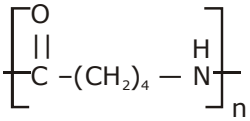
1. The correct statements among (a) to (d) regarding H_2 as a fuel are :
(a) It produces less pollutants than petrol.
(b) A cylinder of compressed dihydrogen weighs ~30 times more than a petrol tank producing the same amount of energy.
(c) Dihydrogen is stored in tanks of metal alloys like $NaNi_5$.
(d) On combustion, values of energy released per gram of liquid dihydrogen and LPG are 50 and 142 kJ. respectively.
(A) (b), (c) and (d) only
(B) (a), (b) and (c) only
(C) (a) and (c) only
(D) (b) and (d) only

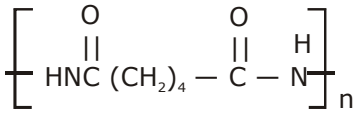
Sol. **B**
Option (a), (b) & (c) are correct answer (NCERT THEORY BASED)

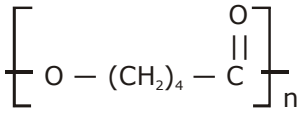
2. The polymer obtained from the following reaction is :



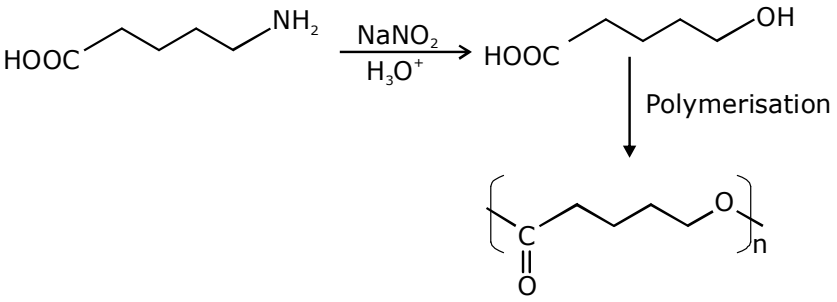
(A) 

(B) 

(C) 

(D) 

Sol. **D**
It is formation of ester



3. If a reaction follows the Arrhenius equation, the plot lnk vs $\frac{1}{RT}$ gives straight line with a gradient (–y) unit. The energy required to activate the reactant is :

(A) y unit (B) y/R unit
(C) – y unit (D) yR unit

Sol. **A**

4. Peroxyacetyl nitrate (PAN), an eye irritant is produced by :

(A) photochemical smog
(B) classical smog
(C) organic waste
(D) acid rain

Sol. **A**
Photochemical smog produce chemicals such as formaldehyde, acrolein and peroxyacetyl nitrate(PAN).

5. Heat treatment of muscular pain involves radiation of wavelength of about 900 nm. Which spectral line of H - atom is suitable for this purpose ?
[$R_H = 1 \times 10^5\ cm^{-1}$, $h = 6.6 \times 10^{-34}$ Js, $c = 3 \times 10^8\ ms^{-1}$]

(A) Paschen $\infty \rightarrow 3$

(B) Lyman, $\infty \rightarrow 1$

(C) Paschen, $5 \rightarrow 3$

(D) Balmer, $\infty \rightarrow 2$

Sol. **A**

6. Match the ores (column A) with the metals (column B) :

	(Column A) Ores	(Column B) Metals
(I)	Siderite	(a) Zinc
(II)	Kaolinite	(b) Copper
(III)	Malachite	(c) Iron
(IV)	Calamine	(d) Aluminium

(A) (I) – (c) ; (II) – (d) ; (III) – (a) ; (IV) – (b)
(B) (I) – (c) ; (II) – (d) ; (III) – (b) ; (IV) – (a)
(C) (I) – (a) ; (II) – (b) ; (III) – (c) ; (IV) – (d)
(D) (I) – (b) ; (II) – (c) ; (III) – (d) ; (IV) – (a)

Sol. **B**
Siderite : $FeCO_3$
Kaolinite : $Al_2(OH)_4Si_2O_5$
Malachite : $Cu(OH)_2CuCO_3$
Calamine : $ZnCO_3$

7. The correct match between items I and II is :

	Item - I (Mixture)	Item - II (Seperation method)
(A)	H_2O : Sugar	(P) Sublimation
(B)	H_2O : Aniline	(Q) Recrystallization
(C)	H_2O : Toluene	(R) Steam distillation
		(S) Differential extraction

(A) (A) $\rightarrow$ S ; (B) $\rightarrow$ R ; (C) $\rightarrow$ (P)

(B) (A) → Q ; (B) → R ; (C) → (P)
(C) (A) → Q ; (B) → R ; (C) → (S)
(D) (A) → R ; (B) → P ; (C) → (S)

Sol. **C**

Sol. (Mixture)	**(Seperation method)**
H_2O : Sugar ⇒	Recrystallization
H_20 : Aniline ⇒	Steam distillation
H_2O : Toluene ⇒	Differential extraction

8. For the chemical reaction X $\rightleftharpoons$ Y, the standard reaction Gibbs energy depends on temperature T (in K) as

$\Delta_r G^\circ$ (in kJ mol^{-1}) = $120 - \frac{3}{8}T$

The major component of the reaction mixture at T is :
(A) X if T = 350 K
(B) Y if T = 280 K
(C) Y is T = 300 K
(D) X if T = 315 K

Sol. **D**

$\Delta G^\circ = 120 - \frac{3}{8} \times 350$

If $\Delta G^\circ < 0$ Then Y will be the mazor

If $\Delta G^\circ > 0$ Then X will be the mazor

9. An organic compound is estimated through Dumus method and was found to evolve 6 moles of CO_2, 4 moles of H_2O and 1 mole of nitrogen gas. The formula of the compound is :

(A) $C_6H_8N_2$

(B) $C_{12}H_8N$

(C) $C_{12}H_8N_2$

(D) $C_6H_8N_2$

Sol. **A**

$[C_xH_yN_z] \xrightarrow[\text{Method}]{\text{Duma}} 6CO_2+4H_2O+N_2$

Hence, $C_6H_8N_2$

10. Two blocks of the same metal having same mass and at temperature T_1 and T_2, respectively, are brought in contact with each other an allowed to attain thermal equilibrium at constant pressure. The change in entropy, ΔS, for this process is :

(A) $2C_P \ln\left[\frac{(T_1+T_2)^{\frac{1}{2}}}{T_1 T_2}\right]$

(B) $2C_P \ln\left[\frac{(T_1+T_2)}{4T_1 T_2}\right]$

(C) $C_P \ln\left[\frac{(T_1+T_2)^2}{4T_1 T_2}\right]$

(D) $2C_P \ln\left[\frac{T_1+T_2}{2T_1 T_2}\right]$

Sol. **C**

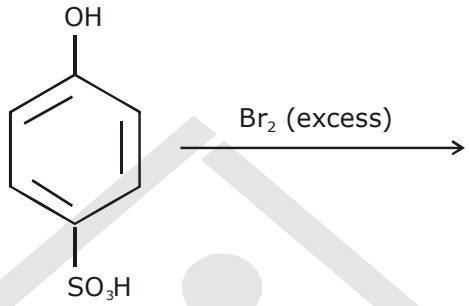
$\Delta S = \Delta S_1 + \Delta S_2$

$$= cp \ln \frac{T_f}{T_i} + cp \ln \frac{T_f}{T_i}$$

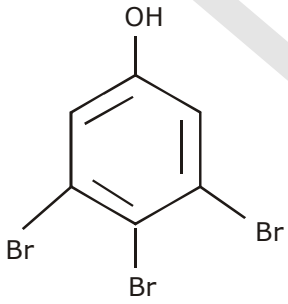
$$= cp \ln \frac{T_1 + T_2}{2T_1} + cp \ln \frac{(T_1 + T_2)}{2T_2}$$

$$= cp \ln \frac{(T_1 + T_2)^2}{4T_1T_2}$$

11. The major product of the following reaction is :



(A)



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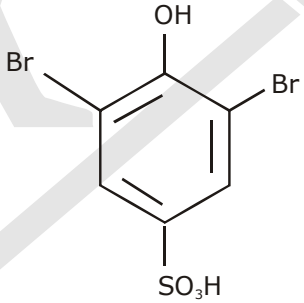

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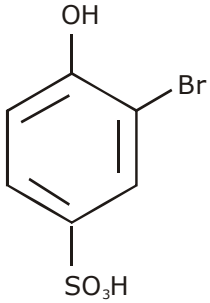
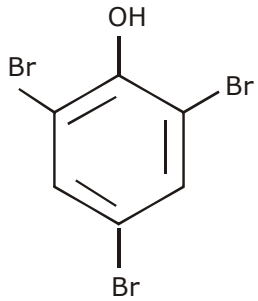
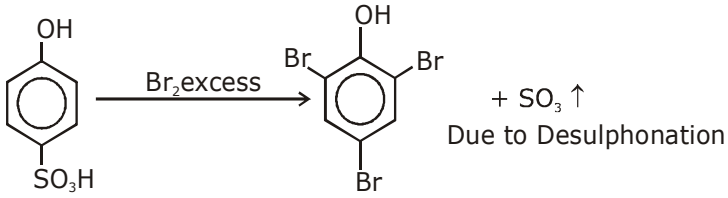


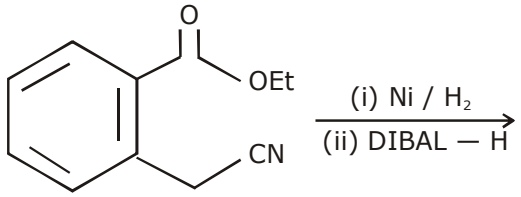
(D)

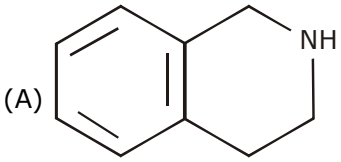


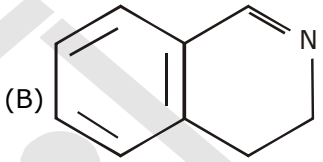
Sol. **D**

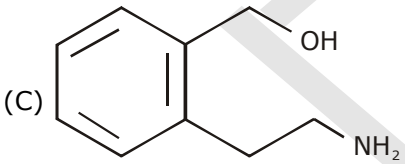


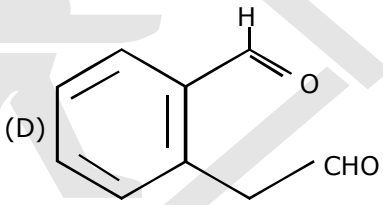
12. The major product of the following reaction is :



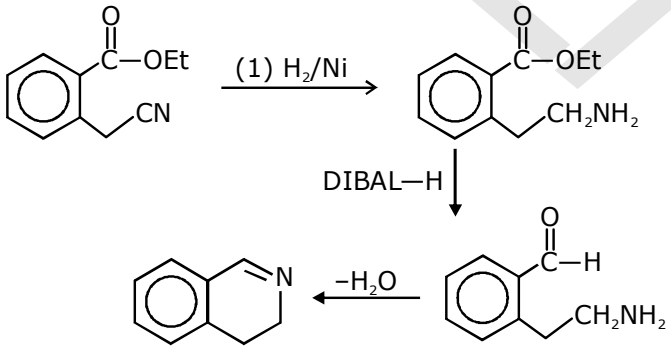








Sol. **B**



13. The chloride that CANNOT get hydrolysed is :

(A) CCl_4

(B) $PbCl_4$

(C) $SnCl_4$

(D) $SiCl_4$

Sol. **A**

CCl_4 cannot get hydrolyzed due to the absence of vacant orbital at carbon atom.

14. The freezing point of a diluted milk sample is found to be – 0.2°C, while it should have been –0.5°C for pure milk. How much water has been added to pure milk to make the diluted sample ?
(A) 1 cup of water to 3 cups of pure milk
(B) 2 cups of water to 3 cups of pure milk
(C) 1 cup of water to 2 cups of pure milk
(D) 3 cups of water to 2 cups of pure milk

Sol. **D**

15. The amphoteric hydroxide is :
(A) $Ca(OH)_2$
(B) $Mg(OH)_2$
(C) $Be(OH)_2$
(D) $Sr(OH)_2$

Sol. **C**
$Be(OH)_2$ is amphoteric in nature while rest all alkaline earth metal hydroxide are basic in nature.

16. The concentration of dissolved oxygen (DO) in cold water can go upto :
(A) 8 ppm
(B) 14 ppm
(C) 16 ppm
(D) 10 ppm

Sol. **D**
In cold water, dissolved oxygen (DO) can reach a concentration upto 10 ppm

17. Consider the reaction
$N_2(g) + 3H_2(g) \rightleftharpoons 2\,NH_3(g)$
The equilibrium constant of the above reaction is K_p. If pure ammonia is left to dissociate, the partial pressure of ammonia at equilibrium is given by (Assume that $P_{NH_3} << P_{total}$ at equilibrium)

(A) $\frac{3^{3/2} K_p^{1/2} P^2}{4}$

(B) $\frac{K_p^{1/2} P^2}{4}$

(C) $\frac{3^{3/2} K_p^{1/2} P^2}{16}$

(D) $\frac{K_p^{1/2} P^2}{16}$

Sol. **C**

18. An example of solid sol. is :
(A) Hair cream
(B) Gem stones
(C) Butter
(D) paint

Sol. **B**

19. The correct match between item (I) and item (II) is :

Item - I	Item - II
(A) Norethindrone	(P) Anti - biotic
(B) Ofloxacin	(Q) Anti-fertility
(C) Equanil	(R) Hypertension
	(S) Analgesics

(A) (A) $\rightarrow$ (Q) ; (B) $\rightarrow$ (P); (C) $\rightarrow$ (R)
(B) (A) $\rightarrow$ (R) ; (B) $\rightarrow$ (P); (C) $\rightarrow$ (S)
(C) (A) $\rightarrow$ (Q) ; (B) $\rightarrow$ (R); (C) $\rightarrow$ (S)
(D) (A) $\rightarrow$ (R) ; (B) $\rightarrow$ (P); (C) $\rightarrow$ (R)

Sol. **A**
(A) Norethindrone - Antifertility
(B) Ofloaxacin - Anti-Biotic
(C) Equanil - Hypertension (traiquilizer)

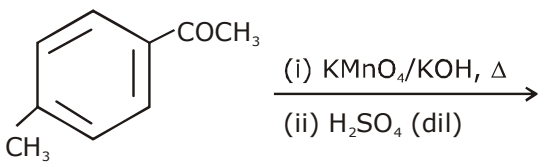
20. The element that usually does NOT show variable oxidation states is :
(A) V (B) Ti (C) Cu (D) Sc

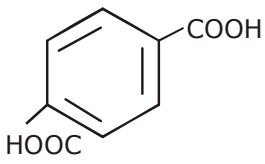
Sol. **D**
Usually Sc(Scandium) does not show variable oxidation states
Most common oxidation states of :
(i) Sc : +3
(ii) V : +2, +3, +4, +5
(iii) Ti : +2, +3, +4
(iv) Cu : +1, +2

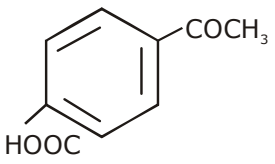
21. A 10 mg effervescent tablet containing sodium bicarbonate and oxalic acid releases 0.25 ml of CO_2 at T = 298.15 K and p = 1 bar. If molar volume of CO_2 is 25.0 L under such condition, what is the percentage of soidum bicarbonate in each tablet. ?
[Molar mass of $NaHCO_3$ = 84 g mol^{-1}]
(A) 33.6 (B) 16.8 (C) 0.84 (D) 8.4

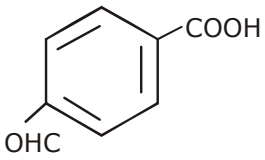
Sol. **B**
effervescent tablet contains Citric acid there for $NaHCO_3$ is converted to H_2CO_3 & It gives CO_2 at room temperature
$H_2CO_3 \rightarrow H_2O+CO_2$
25×10^3 ml ——— 1 mole
0.25 ——— $1/25\times10^3$
10^{-5} moles CO_2 = moles of $NaHCO_3$
Wt. $NaHCO_3$ = $10^{-5}\times10^3\times84$ mgm
% of $NaHCO_3$ = $10^{-2}\times84\times100/10$ = 8.4%

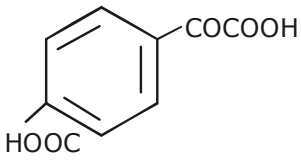
22. The major product of the following reaction is



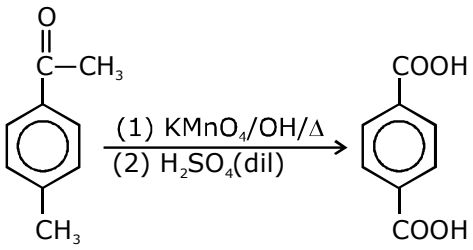
(A) 

(B) 

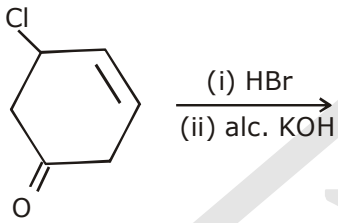
(C) 

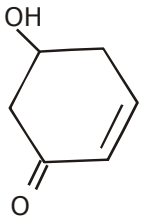
(D) 

Sol. **A**



23. The major product of the following reaction is :



(A) 

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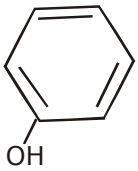
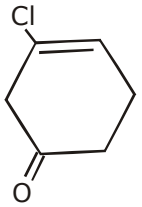
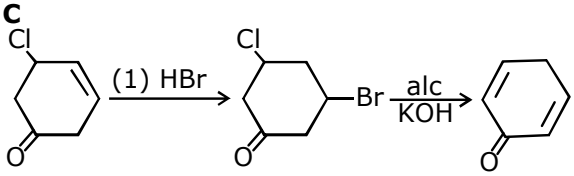
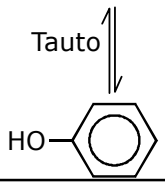
(C) 

(D) 

Sol. **C**





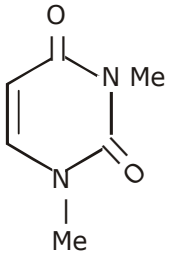
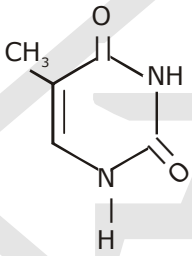
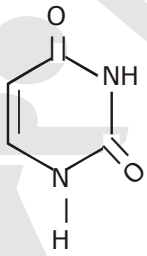
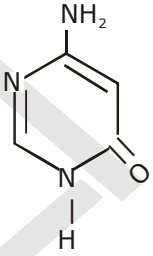
24. Match the metals (column I) with the coordination compound(s) / enzyme (s) (column II) :

Column - I	Column - II
Metals	Coordination compound (s) / enzyme (s)
(A) Co	(i) Wilkinson catalyst
(B) Zn	(ii) Chlorophyll
(C) Rh	(iii) Vitamin B_{12}
(D) Mg	(iv) Carbonic anhydrase

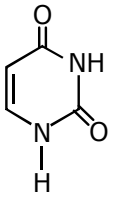
(A) (A)-(iii); (B)-(iv); (C)-(i); (D)-(ii)
(B) (A)-(i); (B)-(ii); (C)-(iii); (D)-(iv)
(C) (A)-(iv); (B)-(iii); (C)-(i); (D)-(ii)
(D) (A)-(ii); (B)-(i); (C)-(iv); (D)-(iii)

Sol. **A**
(i) Wilkinson catalyst : $RhCl(PPh_3)_3$
(ii) Chlorophyll : $C_{55}H_{72}O_5N_4Mg$
(iii) Vitamin B_{12}(also known as cyanocobalamin) contain cobalt.
(iv) Carbonic anhydrase contains a zinc ion.

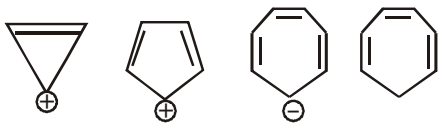
25. Among the following compounds, which one is found is RNA ?

(A) 
(B) 
(C) 
(D) 

Sol. **C**
For the given structure
'uracil' is found in RNA



26. Which compound (s) out of the following is / are not aromatic ?



(A) (B) (C) (D)

(A) (C) and (D)
(B) (B)
(C) (B), (C) and (D)
(D) (A) and (C)

Sol. **C**

out of the given options only  is aromatic.

Hence (B),(C) and (D) are not aromatic

27. The correct order of the atomic radii of C, Cs, Al, and S is :

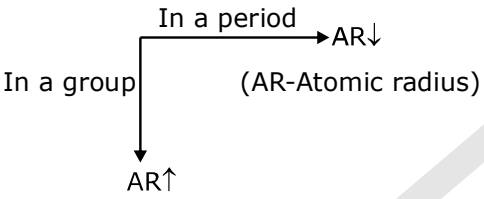
(A) S < C < Cs < Al

(B) C < S < Cs < Al

(C) S < C < Al < Cs

(D) C < S < Al < Cs

Sol. D



Atomic radii order : C < S < Al < Cs

Atomic radius of C : 170 pm

Atomic radius of S : 180 pm

Atomic radius of Al : 184 pm

Atomic radius of Cs : 300 pm

28. NaH is an example of :

(A) saline hydride

(B) electron - rich hydride

(C) molecular hydride

(D) metallic hydride

Sol. A

NaH is an example of ionic hydride which is also known as saline hydride.

29. A solid having density of 9×10^3 kg m^{-3} forms face centred cubic crystals of edge length $200\sqrt{2}$ pm. What is the molar mass of the solid ?

[Avogadro constant $\cong 6 \times 10^{23}$ mol^{-1}, $\pi \cong 3$]

(A) 0.0216 kg mol^{-1}

(B) 0.4320 kg mol^{-1}

(C) 0.0432 kg mol^{-1}

(D) 0.0305 kg mol^{-1}

Sol. D

30. For the cell $Zn(s)|Zn^{2+}(aq)||M^{x+}(aq)|M(s)$ different half cells and their standard electrode potentials are given below

$M^{x+}(aq)/M(s)$	$Au^{3+}(aq)/Au(s)$	$Ag^{+}(aq)/Ag(s)$	$Fe^{3+}(aq)/Fe^{2+}(aq)$	$Fe^{2+}(aq)/Fe(s)$
$E^{0}_{M^{x+}/M}$ / (V)	1.40	0.80	0.77	– 0.44

If $E^{\circ}_{Zn^{2+}/Zn} = -0.76\,V$, which cathode will give a maximum value of E°_{cell} per electron transferred ?

(A) Fe^{3+}/Fe^{2+}

(B) Fe^{2+}/Fe

(C) Au^{3+}/Au

(D) Ag^{+}/Ag

Sol. D