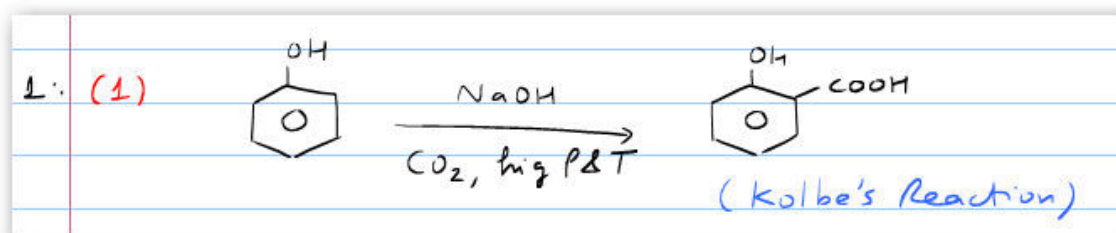


AIEEE-2009
CODE (D)
CHEMISTRY

1. The major product obtained on interaction of phenol with sodium hydroxide and carbon dioxide is :
- (1) salicylic acid
 - (2) phthalic acid
 - (3) benzoic acid
 - (4) salicylaldehyde



2. In which of the following arrangements, the sequence is *not* strictly according to the property written against it ?
- (1) $\text{NH}_3 < \text{PH}_3 < \text{AsH}_3 < \text{SbH}_3$: increasing basic strength
 - (2) $\text{B} < \text{C} < \text{O} < \text{N}$: increasing first ionization enthalpy
 - (3) $\text{CO}_2 < \text{SiO}_2 < \text{SnO}_2 < \text{PbO}_2$: increasing oxidising power
 - (4) $\text{HF} < \text{HCl} < \text{HBr} < \text{HI}$: increasing acid strength

2 : (1) Check that (2), (3) & (4) are correct.

3. Buna-N synthetic rubber is a copolymer of :

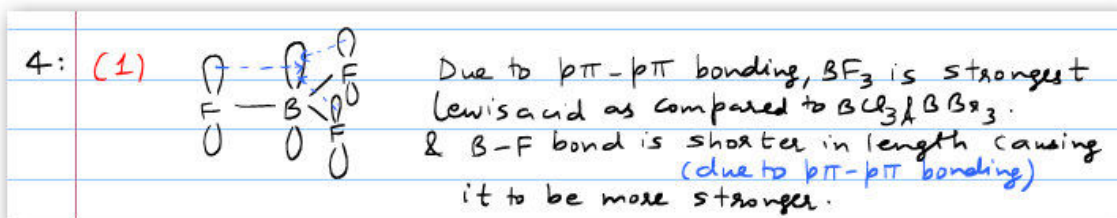
- (1) $\text{H}_2\text{C}=\text{CH}-\text{CN}$ and $\text{H}_2\text{C}=\text{CH}-\text{CH}=\text{CH}_2$
- (2) $\text{H}_2\text{C}=\text{CH}-\text{CN}$ and $\text{H}_2\text{C}=\text{CH}-\underset{\text{CH}_3}{\text{C}}=\text{CH}_2$
- (3) $\text{H}_2\text{C}=\text{CH}-\overset{\text{Cl}}{\text{C}}=\text{CH}_2$ and $\text{H}_2\text{C}=\text{CH}-\text{CH}=\text{CH}_2$
- (4) $\text{H}_2\text{C}=\text{CH}-\text{CH}=\text{CH}_2$ and $\text{H}_5\text{C}_6-\text{CH}=\text{CH}_2$

3: (1) Buna-N : 1,3-butadiene + acrylonitrile

Buna-S : 1,3-butadiene + Styrene

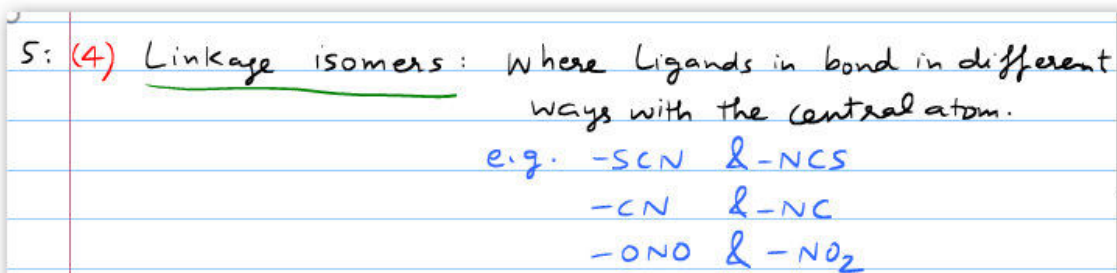
4. The bond dissociation energy of B - F in BF_3 is 646 kJ mol^{-1} whereas that of C - F in CF_4 is 515 kJ mol^{-1} . The correct reason for higher B-F bond dissociation energy as compared to that of C - F is :

- (1) significant $p\pi - p\pi$ interaction between B and F in BF_3 whereas there is no possibility of such interaction between C and F in CF_4 .
- (2) lower degree of $p\pi - p\pi$ interaction between B and F in BF_3 than that between C and F in CF_4 .
- (3) smaller size of B - atom as compared to that of C - atom.
- (4) stronger σ bond between B and F in BF_3 as compared to that between C and F in CF_4 .



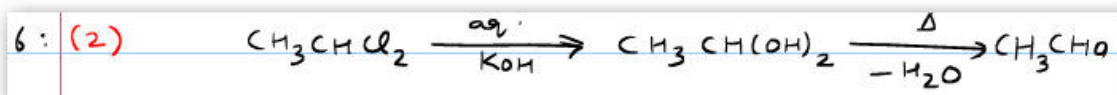
5. Which of the following pairs represents linkage isomers ?

- (1) $[\text{Co}(\text{NH}_3)_5\text{NO}_3]\text{SO}_4$ and $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{NO}_3$
- (2) $[\text{PtCl}_2(\text{NH}_3)_4]\text{Br}_2$ and $[\text{PtBr}_2(\text{NH}_3)_4]\text{Cl}_2$
- (3) $[\text{Cu}(\text{NH}_3)_4][\text{PtCl}_4]$ and $[\text{Pt}(\text{NH}_3)_4][\text{CuCl}_4]$
- (4) $[\text{Pd}(\text{PPh}_3)_2(\text{NCS})_2]$ and $[\text{Pd}(\text{PPh}_3)_2(\text{SCN})_2]$



6. Which of the following on heating with aqueous KOH, produces acetaldehyde ?

- (1) $\text{CH}_2\text{ClCH}_2\text{Cl}$
- (2) CH_3CHCl_2
- (3) CH_3COCl
- (4) $\text{CH}_3\text{CH}_2\text{Cl}$



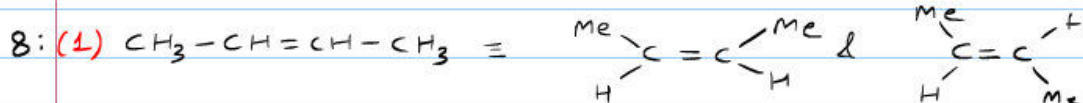


7. In an atom, an electron is moving with a speed of 600 m/s with an accuracy of 0.005% . Certainty with which the position of the electron can be located is ($h = 6.6 \times 10^{-34} \text{ kg m}^2 \text{ s}^{-1}$, mass of electron, $m_e = 9.1 \times 10^{-31} \text{ kg}$):
- (1) $1.92 \times 10^{-3} \text{ m}$
 - (2) $3.84 \times 10^{-3} \text{ m}$
 - (3) $1.52 \times 10^{-4} \text{ m}$
 - (4) $5.10 \times 10^{-3} \text{ m}$

$$7: (1) v = 600 \text{ m s}^{-1}; \quad \Delta v = \frac{600 \times 0.005}{100} = 0.03 \text{ m s}^{-1}$$

$$\Delta x = \frac{h}{4\pi m \Delta v} = \frac{6.6 \times 10^{-34}}{4\pi \times 9.1 \times 10^{-31} \times 0.03} = 1.92 \times 10^{-3} \text{ m}$$

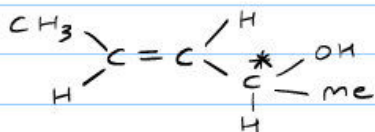
8. The alkene that exhibits geometrical isomerism is :
- (1) 2-butene
 - (2) 2-methyl-2-butene
 - (3) propene
 - (4) 2-methyl propene



9. The number of stereoisomers possible for a compound of the molecular formula $\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}(\text{OH}) - \text{Me}$ is :
- (1) 4
 - (2) 6
 - (3) 3
 - (4) 2



9: (1)



* 1 chiral centre
* Geometric isomers

4' Stereoisomers.

10. Solid $\text{Ba}(\text{NO}_3)_2$ is gradually dissolved in a $1.0 \times 10^{-4} \text{M}$ Na_2CO_3 solution. At what concentration of Ba^{2+} will a precipitate begin to form?

(K_{sp} for $\text{BaCO}_3 = 5.1 \times 10^{-9}$):

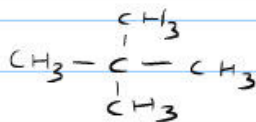
- (1) $8.1 \times 10^{-8} \text{M}$
- (2) $8.1 \times 10^{-7} \text{M}$
- (3) $4.1 \times 10^{-5} \text{M}$
- (4) $5.1 \times 10^{-5} \text{M}$

$$10: (4) \quad [\text{Ba}^{2+}] = \frac{K_{\text{sp}} \text{BaCO}_3}{[\text{CO}_3^{2-}]} = \frac{5.1 \times 10^{-9}}{10^{-4}} = 5.1 \times 10^{-5} \text{M}$$

11. The IUPAC name of neopentane is :

- (1) 2 - methylpropane
- (2) 2, 2 - dimethylbutane
- (3) 2 - methylbutane
- (4) 2, 2 - dimethylpropane

11: (4)



2,2 - Dimethylpropane



12. Calculate the wavelength (in nanometer) associated with a proton moving at $1.0 \times 10^3 \text{ m s}^{-1}$
(Mass of proton = $1.67 \times 10^{-27} \text{ kg}$ and $h = 6.63 \times 10^{-34} \text{ Js}$) :
- (1) 2.5 nm
 - (2) 14.0 nm
 - (3) 0.032 nm
 - (4) 0.40 nm

$$12: (4) \quad \lambda = \frac{h}{mv} = \frac{6.63 \times 10^{-34}}{1.67 \times 10^{-27} \times 10^3} \approx 0.397 \text{ nm}$$

13. The set representing the *correct* order of ionic radius is :
- (1) $\text{Li}^+ > \text{Na}^+ > \text{Mg}^{2+} > \text{Be}^{2+}$
 - (2) $\text{Mg}^{2+} > \text{Be}^{2+} > \text{Li}^+ > \text{Na}^+$
 - (3) $\text{Li}^+ > \text{Be}^{2+} > \text{Na}^+ > \text{Mg}^{2+}$
 - (4) $\text{Na}^+ > \text{Li}^+ > \text{Mg}^{2+} > \text{Be}^{2+}$

$$13: (4) \quad \begin{array}{l} \text{Li}^+ : 76 \text{ pm} \\ \text{Mg}^{2+} : 72 \text{ pm} \end{array} \quad \text{Na}^+ : 102 \text{ pm}$$

14. Arrange the carbanions, $(\text{CH}_3)_3\bar{\text{C}}$, $\bar{\text{C}}\text{Cl}_3$, $(\text{CH}_3)_2\bar{\text{C}}\text{H}$, $\text{C}_6\text{H}_5\bar{\text{C}}\text{H}_2$ in order of their decreasing stability :
- (1) $\bar{\text{C}}\text{Cl}_3 > \text{C}_6\text{H}_5\bar{\text{C}}\text{H}_2 > (\text{CH}_3)_2\bar{\text{C}}\text{H} > (\text{CH}_3)_3\bar{\text{C}}$
 - (2) $(\text{CH}_3)_3\bar{\text{C}} > (\text{CH}_3)_2\bar{\text{C}}\text{H} > \text{C}_6\text{H}_5\bar{\text{C}}\text{H}_2 > \bar{\text{C}}\text{Cl}_3$
 - (3) $\text{C}_6\text{H}_5\bar{\text{C}}\text{H}_2 > \bar{\text{C}}\text{Cl}_3 > (\text{CH}_3)_3\bar{\text{C}} > (\text{CH}_3)_2\bar{\text{C}}\text{H}$
 - (4) $(\text{CH}_3)_2\bar{\text{C}}\text{H} > \bar{\text{C}}\text{Cl}_3 > \text{C}_6\text{H}_5\bar{\text{C}}\text{H}_2 > (\text{CH}_3)_3\bar{\text{C}}$



14: (1) $\bar{C}Cl_3$: 3 Cl atom stabilises -ive charge over C atom strongly
 [More than resonance in benzyli]
 $ph \bar{C}H_2$: Resonance Stabilisation.
 +I effect of R groups destabilises Carbanions.

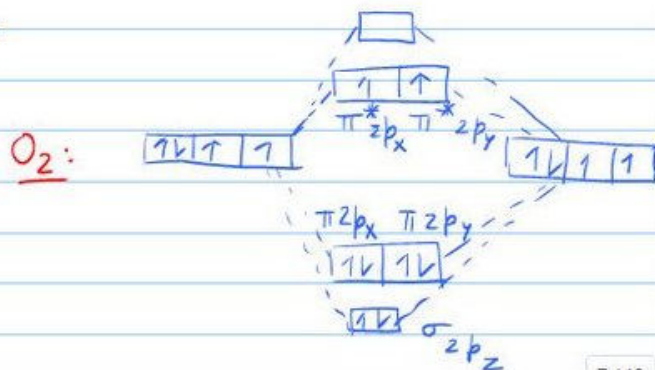
15. Using MO theory predict which of the following species has the shortest bond length ?

- (1) O_2^-
- (2) O_2^{2-}
- (3) O_2^{2+}
- (4) O_2^+

15: (3) Species B.O.

O_2^-	1.5
O_2^{2-}	1.0
O_2^{2+}	3
O_2^+	2.5

B.O. $\propto \frac{1}{\text{Bond length}}$



16. Which one of the following reactions of Xenon compounds is *not* feasible ?

- (1) $2 \text{Xe F}_2 + 2 \text{H}_2\text{O} \rightarrow 2 \text{Xe} + 4 \text{HF} + \text{O}_2$
- (2) $\text{Xe F}_6 + \text{RbF} \rightarrow \text{Rb [Xe F}_7]$
- (3) $\text{Xe O}_3 + 6 \text{HF} \rightarrow \text{Xe F}_6 + 3 \text{H}_2\text{O}$
- (4) $3 \text{Xe F}_4 + 6 \text{H}_2\text{O} \rightarrow 2 \text{Xe} + \text{Xe O}_3 + 12 \text{HF} + 1.5 \text{O}_2$

16: (3) $\text{XeO}_3 + 6 \text{HF} \rightarrow \text{No Reaction}$

17. The two functional groups present in a typical carbohydrate are :

- (1) $>\text{C}=\text{O}$ and $-\text{OH}$
- (2) $-\text{OH}$ and $-\text{CHO}$
- (3) $-\text{OH}$ and $-\text{COOH}$
- (4) $-\text{CHO}$ and $-\text{COOH}$

17: (1) Typical carbohydrates contain: $-\text{OH}$ & $>\text{C}=\text{O}$ groups.
 (includes both keto & aldehydes)

18. The half life period of a first order chemical reaction is 6.93 minutes. The time required for the completion of 99% of the chemical reaction will be ($\log 2 = 0.301$)

- (1) 46.06 minutes
- (2) 460.6 minutes
- (3) 230.3 minutes
- (4) 23.03 minutes



$$18: (1) \quad t_{1/2} = \frac{0.693}{k} \Rightarrow k = \frac{0.693}{6.93} \text{ min}^{-1} = 0.1 \text{ min}^{-1}$$

$$k t = 2.303 \log_{10} \frac{C_0}{C_t}$$

$$\Rightarrow 0.1 \times t = 2.303 \log_{10} \frac{C_0}{0.01 C_0} = 4.606$$

$$\Rightarrow t = 46.06 \text{ min}$$

19. Two liquids X and Y form an ideal solution. At 300 K, vapour pressure of the solution containing 1 mol of X and 3 mol of Y is 550 mmHg. At the same temperature, if 1 mol of Y is further added to this solution, vapour pressure of the solution increases by 10 mmHg. Vapour pressure (in mmHg) of X and Y in their pure states will be, respectively :
- (1) 400 and 600
 - (2) 500 and 600
 - (3) 200 and 300
 - (4) 300 and 400

$$19: (1) \quad 550 = P_X^{\circ} \times \left(\frac{1}{4}\right) + P_Y^{\circ} \left(\frac{3}{4}\right) - (i)$$

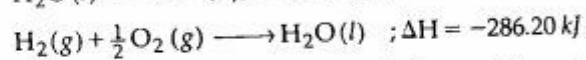
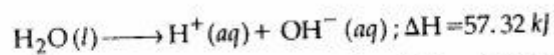
$$\& \quad 560 = P_X^{\circ} \times \left(\frac{1}{5}\right) + P_Y^{\circ} \left(\frac{4}{5}\right) - (ii)$$

Solve to get :

$$P_X^{\circ} = 400 \text{ mmHg}$$

$$\& \quad P_Y^{\circ} = 600 \text{ mmHg}$$

20. On the basis of the following thermochemical data : ($\Delta_f G^\circ H_{(aq)}^+ = 0$)



The value of enthalpy of formation of OH^- ion at $25^\circ C$ is :

- (1) +228.88 kJ
- (2) -343.52 kJ
- (3) -22.88 kJ
- (4) -228.88 kJ

20: (4) $H_2O(l) \longrightarrow H^+ + OH^- \quad \Delta H = 57.32 \text{ kJ}$

$H_2(g) + \frac{1}{2} O_2(g) \longrightarrow H_2O(l) \quad \Delta H = -286.2 \text{ kJ}$
 $\equiv \Delta_f H_{H_2O}^\ominus$

$\Delta H = \sum H_p - \sum H_R = H_{H^+} + H_{OH^-} - H_{H_2O}$

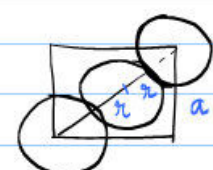
$57.32 = 0 + x - (-286.2)$

$\Rightarrow x = -228.88 \text{ kJ}$
 $= \Delta_f H_{OH^-}$

21. Copper crystallises in fcc with a unit cell length of 361 pm. What is the radius of copper atom ?

- (1) 157 pm
- (2) 181 pm
- (3) 108 pm
- (4) 127 pm

21: (4) fcc:



$\sqrt{2} a = 4r$

$\Rightarrow r = \frac{\sqrt{2} a}{4} = 127 \text{ pm}$

22. Given :

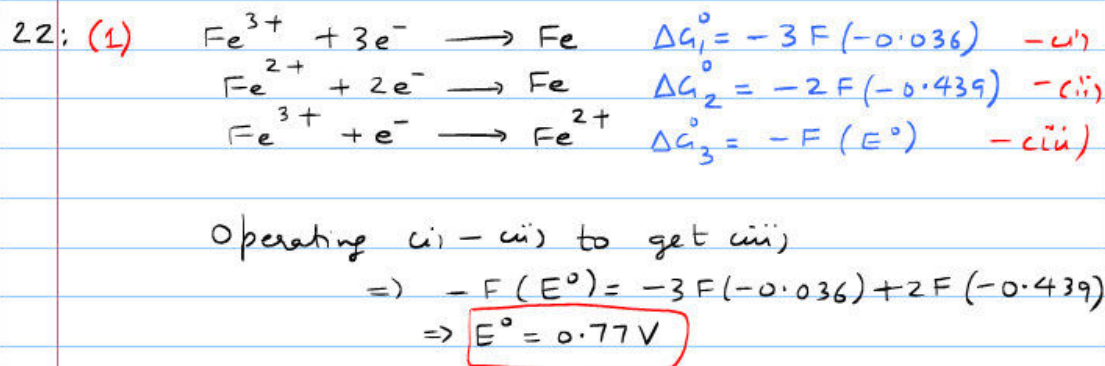
$$E_{\text{Fe}^{3+}/\text{Fe}}^0 = -0.036 \text{ V}, \quad E_{\text{Fe}^{2+}/\text{Fe}}^0 = -0.439 \text{ V}$$

The value of standard electrode potential

for the change, $\text{Fe}_{(\text{aq})}^{3+} + e^- \rightarrow \text{Fe}_{(\text{aq})}^{2+}$

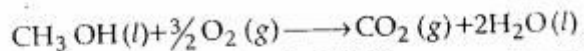
will be :

- (1) 0.770 V
- (2) -0.270 V
- (3) -0.072 V
- (4) 0.385 V



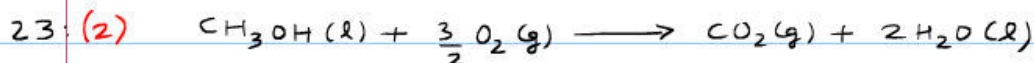


23. In a fuel cell methanol is used as fuel and oxygen gas is used as an oxidizer. The reaction is



At 298 K standard Gibb's energies of formation for $\text{CH}_3\text{OH}(l)$, $\text{H}_2\text{O}(l)$ and $\text{CO}_2(g)$ are -166.2 , -237.2 and $-394.4 \text{ kJ mol}^{-1}$ respectively. If standard enthalpy of combustion of methanol is -726 kJ mol^{-1} , efficiency of the fuel cell will be :

- (1) 90%
(2) 97%
(3) 80%
(4) 87%



$$\begin{aligned} \Delta G^\ominus &= \sum G_p^\ominus - \sum G_R^\ominus = \Delta_f G_{\text{CO}_2}^\ominus + \Delta_f G_{\text{H}_2\text{O}}^\ominus \\ &\quad - \Delta_f G_{\text{CH}_3\text{OH}}^\ominus - \frac{3}{2} \Delta_f G_{\text{O}_2}^\ominus \\ \Rightarrow \Delta G^\ominus &= (-394.4) + 2(-237.2) - (-166.2) \\ &= -702.6 \text{ kJ mol}^{-1} \end{aligned}$$

Assume decrease in Gibbs energy = Decrease in Enthalpy

$$\eta = \frac{702.6}{726} \approx 97\%$$

24. In context with the transition elements, which of the following statements is *incorrect* ?
- (1) In the highest oxidation states of the first five transition elements (Sc to Mn), all the 4s and 3d electrons are used for bonding.
 - (2) Once the d^5 configuration is exceeded, the tendency to involve all the 3d electrons in bonding decreases.
 - (3) In addition to the normal oxidation states, the zero oxidation state is also shown by these elements in complexes.
 - (4) In the highest oxidation states, the transition metal show basic character and form cationic complexes.

24: (4) Transition metal shows acidic character.

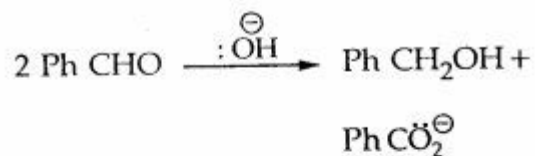
25. Which of the following has an optical isomer ?
- (1) $[\text{Co}(\text{H}_2\text{O})_4(\text{en})]^{3+}$
 - (2) $[\text{Co}(\text{en})_2(\text{NH}_3)_2]^{3+}$
 - (3) $[\text{Co}(\text{NH}_3)_3\text{Cl}]^+$
 - (4) $[\text{Co}(\text{en})(\text{NH}_3)_2]^{2+}$



25: (2) For optical isomer to exist, the complex should be octahedral (only cis isomer).



26. In Cannizzaro reaction given below

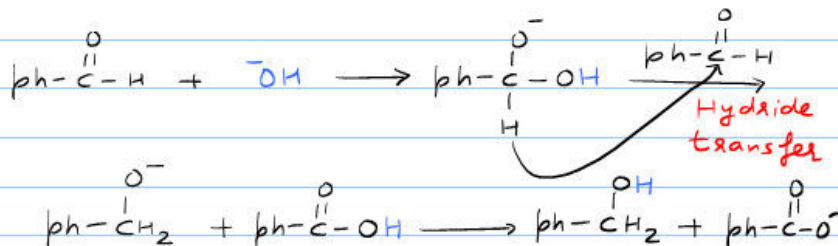


the slowest step is :

- (1) the abstraction of proton from the carboxylic group
- (2) the deprotonation of $\text{Ph CH}_2\text{OH}$
- (3) the attack of $:\text{OH}^-$ at the carboxyl group
- (4) the transfer of hydride to the carbonyl group

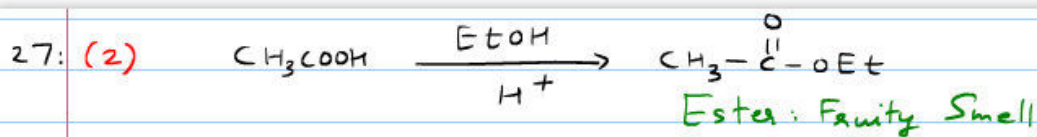


26: (4) Hydride transfer to carbonyl group is the RDS in Cannizzaro reaction.



27. A liquid was mixed with ethanol and a drop of concentrated H_2SO_4 was added. A compound with a fruity smell was formed. The liquid was :

- (1) CH_3COCH_3
- (2) CH_3COOH
- (3) CH_3OH
- (4) HCHO



28. Knowing that the Chemistry of lanthanoids (Ln) is dominated by its +3 oxidation state, which of the following statements is *incorrect* ?
- (1) Ln (III) compounds are generally colourless.
 - (2) Ln (III) hydroxides are mainly basic in character.
 - (3) Because of the large size of the Ln (III) ions the bonding in its compounds is predominantly ionic in character.
 - (4) The ionic sizes of Ln (III) decrease in general with increasing atomic number.

28: (1) Ln compounds are coloured.

29. Which of the following statements is *incorrect* regarding physisorptions ?
- (1) Under high pressure it results into multi molecular layer on adsorbent surface.
 - (2) Enthalpy of adsorption ($\Delta H_{\text{adsorption}}$) is low and positive.
 - (3) It occurs because of van der Waal's forces.
 - (4) More easily liquefiable gases are adsorbed readily.

29: (2) In physisorption, $\Delta H_{\text{adsorption}}$ is -ive.

30. A binary liquid solution is prepared by mixing *n*-heptane and ethanol. Which one of the following statements is *correct* regarding the behaviour of the solution ?
- (1) The solution is non-ideal, showing –ve deviation from Raoult's Law.
 - (2) *n*-heptane shows +ve deviation while ethanol shows –ve deviation from Raoult's Law.
 - (3) The solution formed is an ideal solution.
 - (4) The solution is non-ideal, showing +ve deviation from Raoult's Law.

30: (4) Mixture of *n*-heptane & ethanol shows +ive deviation from Raoult's law.