Q. 1. Arrange the carbanions $(CH_3)_3\overline{C}, \overline{C}Cl_3, (CH_3)_2\overline{C}H, C_6H_5\overline{C}H_2$, in order of their decreasing stability:

1. $(CH_3)_3\overline{C} > (CH_3)_2\overline{C}H > C_6H_5\overline{C}H_2 > \overline{C}Cl_3$
2. $C_6H_5\overline{C}H_2 > \overline{C}Cl_3 > (CH_3)_3\overline{C} > (CH_3)_2\overline{C}H$
3. $(CH_3)_2\overline{C}H > \overline{C}Cl_3 > C_6H_5\overline{C}H_2 > (CH_3)_3\overline{C}$
4. $\overline{C}Cl_3 > C_6H_5\overline{C}H_2 > (CH_3)_2\overline{C}H\ (CH_3)_3\overline{C}$

Answer : (4)

Q. 2. In Cannizzaro reaction given below

$2PhCHO \xrightarrow{\overset{\ominus}{O}H} PhCH_2OH + PhCO_2^{\ominus}$ the slowest step is:

1. **the deprotonation of $PhCH_2OH$**
2. **the attack of $:\overset{\ominus}{\ddot{O}}H$ at the carboxyl group**
3. **the transfer of hydride of the carbonyl group**
4. **the abstraction of proton from the carboxylic group**

Answer : (3)

Q. 3. 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. **500 and 600**
2. **200 and 300**

3. 300 and 400
4. 400 and 600

Answer : (4)

Q. 4. In a fuel cell, methanol is used as fuel and oxygen gas is used as an oxidizer. The reaction is $CH_3\,OH\,(l) + 3/2O_2\,(g) \rightarrow CO_2\,(g) + 2H_2O\,(l)$**; At 298 K standard Gibb's energies of formation for CH_3OH(*l*), H_2O(*l*) and CO_2(g) are –166.2, –237.2 and –394.4 kJ mol^{-1} respectively. If standard enthalpy of combustion of methanol is –726 kJ mol^{-1}, efficiency of the fuel cell will be**

1. 97%
2. 80%
3. 87%
4. 90%

Answer : (1)

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Answer : (1)

Q. 5. On the basis of the following thermochemical data:

$$\left(\Delta_f G^0 H^+_{(aq)} = 0\right)$$

$$H_2O\ (l) \rightarrow H^+(aq) + OH^-\ (aq)\ ;\ \Delta H = 57.32\ KJ$$

$$H_2\ (g) + 1/2O_2\ (g) \rightarrow H2O\ (l)\ ;\ \Delta H = 286.20\ KJ$$

The value of enthalpy of formation of OH^- ion at 25^0 C is :

1. **-343.52 kJ**
2. **-22.88 kJ**
3. **-228.88 kJ**
4. **+228.88 kJ**

Q. 6. 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. **460.6 minutes**
2. **230.3 minutes**
3. **23.03 minutes**
4. **46.06 minutes**

Answer : (4)

Q. 7. Copper crystallises in fcc with a unit cell length of 361 pm. What is the radius of copper atom?

1. **181 pm**
2. **108 pm**
3. **127 pm**
4. **157 pm**

Answer : (3)

Q. 8. Given $E^0_{Fe^{3+}/Fe} = -0.036\ V.\ E^0_{Fe^{2+}/Fe} = -0.439\ V.$ **The value of standard electrode potential for the change,** $Fe^{3+}\ (aq) + e^- \rightarrow Fe^{2+}\ (aq)\ will\ be$

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

Answer : (4)

Q. 9. In which of the following arrangements, the sequence is *not* strictly according to the property written against it?

1. **B < C < O < N; increasing first ionization enthalpy**
2. **CO_2 < SiO_2 < SnO_2 < PbO_2: increasing oxidising power**
3. **HF < HC*l* < HBr < HI: increasing acid strength**
4. **NH_3 < PH_3 < AsH_3 < SbH_3: increasing basic strength**

Answer : (4)

Q. 10. Knowing that the chemistry of lanthanoids (Ln) is dominated by its +3 oxidation state, which of the following statements is*incorrect*?

1. **Ln (III) hydroxides are mainly basic in character.**
2. **Because of the large size of the Ln (III) ions the bonding in its compounds is predominantly ionic in character.**
3. **The ionic sizes of Ln (III) decrease in general with increasing atomic number.**
4. **Ln (III) compounds are generally colourless.**

Answer : (4)

Q. 11. The set representing the *correct* order of ionic radius is:

1. $Mg^{2+} > Be^{2+} > Li^{-+} > Na^{+}$
2. $Li^{-+} > Be^{2+} > Na^{+} > Mg^{2+}$
3. $Na^{+} > Li^{-+} > Mg^{2+} > Be^{2+}$
4. $Li^{-+} > Na^{+} > Mg^{2+} > Be^{2+}$

Answer : (3)

Q. 12. Buna–N synthetic rubber is a copolymer of:

1. $H_2C = CH - CN \text{ and } H_2C = CH - \underset{\displaystyle CH_3}{\underset{|}{C}} = CH_2$
2. $H_2C = CH - \overset{\displaystyle cl}{\overset{|}{C}} = CH_2 \text{ and } H_2C = CH - CH = CH_2$
3. $H_2C = CH - CH = CH_2 \text{ and } H_5C_6 - CH = CH_2$
4. $H_2C = CH - CN \text{ and } H_2C = CH - CH = CH_2$

Answer : (4)

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4. $H_2C = CH - CN \text{ and } H_2C = CH - CH = CH_2$

Answer : (4)

Q. 13. Which of the following statements is *incorrect* regarding physiosorption?

1. **Enthalpy of adsorption $(\Delta H\ adsorption)$ is low and positive.**
2. **It occurs because of Van der Waal's forces.**
3. **More easily liquefiable gases are adsorbed readily.**
4. **Under high pressure it results into multi molecular layer on adsorbent surface.**

Answer : (1)

Q. 14. The number of stereoisomers possible for a compound of the molecular formula $CH_3-CH=CH-CH\ (OH)-$ Me is:

1. **6**
2. **3**
3. **2**
4. **4**

Isomer 1: cis d ; Isomer 2: cis *l* ; Isomer 3: trans d ; Isomer 4: trans *l*

Answer : (4)

Q. 15. The two functional groups present in a typical carbohydrate are:

1. **–OH and –CHO**
2. **–OH and –COOH**
3. **–CHO and –COOH**
4. $>C=O$ and - OH

Answer : (4)

Q. 16. Calculate the wavelength (in nanometer) associated with a proton moving at $1.0\times10^{3}\ ms^{-1}\left(Mass\ of\ proton=1.67\times10^{-27}\ kg\ and\ h=6.63\times10-^{34}\ Js\right)$:

1. **14.0 nm**
2. **0.032 nm**

3. 0.40 nm
4. 2.5 nm

Answer: (3)

Q. 17. 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. lower degree of $p\pi - p\pi$ interaction between B and F in BF_3 than that between C and F in CF_4.
2. smaller size of B atoms as compared to that of C atom.
3. stronger σ bond between B and F in BF3 as compared to that between C and F in CF_4
4. 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 .

Answer: (4)

Q. 18. The major product obtained on interaction of phenol with sodium hydroxide and carbon dioxide is:

1. phthalic acid
2. benzoic acid
3. salicylaldehyde
4. salicylic acid

Answer: (4)

Q. 19. Solid $Ba(NO_3)_2$ is gradually dissolved in $1.0 \times 10^{-4}\ M\ Na_2CO_3$ solution. At what concentration of Ba^{2+} will a precipitate begin to form? $\left(K_{sp}\ for\ Ba\ CO_3 = 5.1 \times 10^{-9}\right)$:

1. $8.1 \times 10^{-7}\ M$

2. $4.1 \times 10^{-5}\ M$
3. $5.1 \times 10^{-5}\ M$
4. $8.1 \times 10^{-8}\ M$

Answer: (3)

Q. 20. Which one of the following reactions of xenon compounds is *not* feasible?

1. $XeF_6 + RbF \rightarrow Rb\left[XeF_7\right]$
2. $XeO_3 + 6HF \rightarrow XeF_6 + 3H_2O$
3. $3XeF_4 + 6H_2O \rightarrow 2Xe + XeO_3 + 12HF + 1.5O_2$
4. $2XeF_2 + 2H_2O \rightarrow 2Xe + 4HF + O_2$

Answer: (2)

Q. 21. The IUPAC name of neopentane is:

1. **2,2–dimethylbutane**
2. **2–methylbutane**
3. **2,2-dimethylpropane**
4. **2–methylpropane**

Answer: (3)

Q. 22. In context with the transition elements, which of the following statements is *incorrect*?

1. **Once the *d*^{5} configuration is exceeded, the tendency to involve all the 3*d* electrons in bonding decreases.**
2. **In addition to the normal oxidation states, the zero oxidation state is also shown by these elements in complexes.**
3. **In the highest oxidation states, the transition metal show basic character and form cationic complexes.**

4. In the highest oxidation states of the first five transition elements (Sc to Mn), all the 4*s* and 3d electrons are used for bonding.

Answer: (3)

Q. 23. Which of the following pairs represents linkage isomers?

1. $[PtCl_2(NH_3)4]Br_2$ and $[PtBr_2(NH_3)_4]Cl_2$
2. $[Cu(NH_3)_4][PtCl_4]$ and $[Pt(NH_3)_4]$ $[CuCl_4]$
3. $[Pd(PPh_3)_2(NCS)_2]$ and $[Pd(PPh_3)_2(SCN)_2]$
4. $[Co(NH_3)5NO_3]SO_4$ and $[Co(NH_3)5SO_4]NO_3$

Answer: (3)

Q. 24. In an atom, an electron is moving with a speed of 600 m/s with an accuracy of 0.005%. Certainity with which the position of the electron can be located is $(h = 6.6 \times 10^{-34}\ Kg\, m^2 s^{-1}, mass\ of\ electron, = 9.1 \times 10^{-31}\ Kg):$

1. $3.84 \times 10^{-3}\ m$
2. $1.52 \times 10^{-4}\ m$
3. $5.10 \times 10^{-3}\ m$
4. $1.92 \times 10^{-3}\ m$

Answer: (4)

Q. 25. Which of the following on heating with aqueous KOH, produces acetaldehyde?

1. CH_3CHCl_2
2. CH_3COCl
3. CH_3CH_2Cl
4. CH_2ClCH_2Cl

Answer: (1)

Q. 26. 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_3COOH**
2. **CH_3OH**
3. **HCHO**
4. **CH_3COCHb3**

Answer: (1)

Q. 27. Using MO theory predict which of the following species has the shortest bond length?

1. O_2^{2-}
2. O_2^{2+}
3. O_2^{+}
4. O_2^{-}

Answer: (2)

Q. 28. 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. **n–heptane shows +ve deviation while ethanol shows –ve deviation from Raoult's Law.**
2. **The solution formed is an ideal solution.**
3. **The solution is non-ideal, showing +ve deviation from Raoult's law.**
4. **The solution is non-ideal, showing –ve deviation from Raoult's Law.**

Answer: (3)

Q. 29. The alkene that exhibits geometrical isomerism is:

1. **2–methyl–2–butene**
2. **propene**
3. **2–methyl propene**
4. **2–butene**

Answer: (4)

Q. 30. Which of the following has an optical isomer?

1. $\left[Co(en)_2(NH_3)_2\right]^{3+}$
2. $\left[Co(NH_3)_3Cl\right]^{+}$
3. $\left[Co(en)(NH_3)_2\right]^{2+}$
4. $\left[Co(H_2O)_4(en)\right]^{3+}$

Answer: (1)