

ANSWER KEY

Test # 01

Test Pattern : BOARD

Class-XII

Chemistry

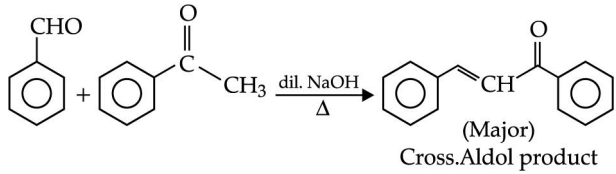
- Option (B) is correct.**

0.1 M HCl solution, conductivity is higher for strong electrolyte, conductivity decreases with dilution.

Explanation: Strong electrolytes (HCl) have higher conductivity than weak electrolytes (CH₃COOH), i.e., the HCl molecules are more likely to ionise (break down into ions) in water, which increases the electrical conductivity of the solution. During dilution, the number of ions present per unit volume carrying the current tends to decrease, which results in a decrease in the conductivity of the electrolytic solution. Thus, 0.1 M HCl solution has more ions than a solution of 0.001 M HCl.
- Option (C) is correct.**

A = Benzaldehyde, B = Acetophenone. This is an example of crossed Aldol condensation.

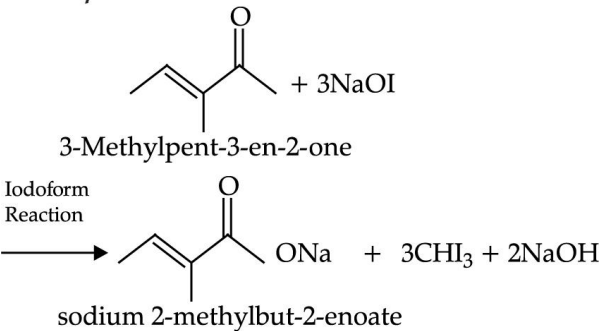
Explanation:


- Option (D) is correct.**

Vitamin A, D, E and K. These are fat soluble vitamins. Fat soluble vitamins can be stored in our body.
- Option (A) is correct.**

3-Methylpent-3-en-2-one

Explanation:



sodium 2-methylbut-2-enoate
- Option (B) is correct.**

The carbon-magnesium bond is covalent and non-polar in nature.

- Explanation:* The bond between carbon and magnesium is ionic in nature, (grignard reagent R-Mg-X. This is highly polar in nature due to difference in electronegativity between carbon and magnesium.
- Option (A) is correct.**

Explanation: Zinc has no unpaired electrons in 3d or 4s orbitals, so enthalpy of atomisation is low.

Mn = 3d⁵4s² shows +2, +3, +4, +5, +6 and +7 oxidation state, maximum number in 3d series. Scandium (Sc) do not form coloured compound because in d-orbital only one electron is available. Hence, d-d transition do not take place.
- Option (B) is correct.**

Molecularity has no meaning for complex reactions.

Explanation: Only for elementary reactions molecularity is applicable as they are the single step reactions and the rate depends on the concentration of each molecule, whereas in case of complex reactions there are multiple reactions involved and hence molecularity holds no meaning.
- Option (C) is correct.**

Water

Explanation: The relatively high solubility is attributed to the hydrogen bonding that takes place between the ammonia and water molecules. The dissolving of ammonium ions in water forms a basic solution.
- Option (B) is correct.**

Explanation: no turbidity will be observed, given compound is a primary alcohol.
- Option (A) is correct.**

Explanation: 0.00625 molL⁻¹s⁻¹, for zero order

$$K = \frac{[R_0] - [R]}{t} = \frac{1.5 - 0.75}{120} = 0.00625 \text{ molL}^{-1}\text{s}^{-1}$$
- Option (A) is correct.**

Due to the activation of benzene ring by the methoxy group.

Explanation: In electrophilic aromatic substitution reaction, anisole undergo bromination with bromine in ethanoic acid (acetic acid) to form mixture of o- and p- bromo anisole. H atom attached to benzene ring is replaced with bromine atom as methoxy group is o, p-directing group.

12. Option (B) is correct.

atomic radii

Explanation: Atomic radius in a transition series does not vary much due to more pronounced shielding effect of penultimate d-subshell in transition elements. Thus, atomic radii of the first transition series decrease from Sc to Cr, then remains almost constant till Ni and then increases from Cu to Zn.

13. Option (C) is correct.

A is true but R is false

Explanation: Alcohols react both as nucleophiles and electrophiles. The bond between O – H is broken when an alcohol reacts as a nucleophile whereas the bond between C – O is broken when alcohols react as electrophiles.

14. Option (B) is correct.

Both A and R are true but R is not the correct explanation of A

Explanation: Toluene is oxidised with alkaline KMnO_4 followed by acidification to form benzoic acid. The oxidation can be stopped at the aldehyde stage by using those suitable reagents to convert the methyl group to an intermediate that cannot be oxidised further such as using CrO_2Cl_2 , CrO_3 or treating by Gatterman -Koch reaction.

15. Option (B) is correct.

Both A and R are true and R is not the correct explanation of A.

Explanation: Enzymes are substrate selective and reaction specific; i.e., enzymes are highly specific in their action. Each enzyme catalyzes only one type of reaction in only one compound or a group of structurally related compounds.

16. Option (D) is correct.

A is false but R is true. Cu will deposit at cathode

Explanation: Cu will deposit at cathode because copper is below hydrogen in the electrochemical series.

17.

(a) For first order reaction

half life of X = 12 hours

2 days = 48 hours means 4 half lives, amount of X left = $1/16$ of initial value half life of Y = 16 hours (1/2)

2 days = 48 hours means 3 half lives, amount left = $1/8$ of initial value Ratio of X : Y = 1 : 2 (1/2)

(b) $\text{mol}^{1/2}\text{L}^{-1/2}\text{s}^{-1}$ as Rate = $k[\text{P}]^{1/2}$ (1)

Explanation:

Rate = $k[\text{P}]^{1/2} [\text{Q}]^0$

$[\text{molL}^{-1}\text{s}^{-1}] = k[\text{molL}^{-1}]$

Unit of $k = \text{mol}^{1/2}\text{L}^{-1/2}\text{s}^{-1}$

18.

$\pi_1 = \pi_2$ (1/2)

$iC_1RT = C_2RT$ (1/2)

$$\frac{3 \times 5}{322} = \frac{2}{M}$$

$$M = \frac{2 \times 322}{3 \times 5}$$

$$M = 42.9 \text{ g}$$

19.

(a) m-dichlorobenzene < o-dichlorobenzene < p-dichlorobenzene (1/2)

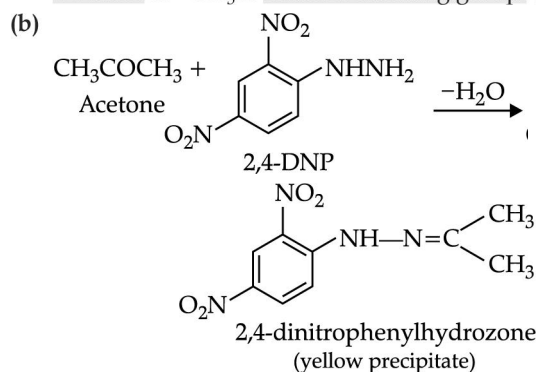
Symmetrical structure and close packing in para isomer

ortho has a stronger dipole dipole interaction as compared to meta, (1/2)

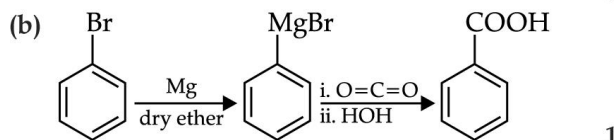
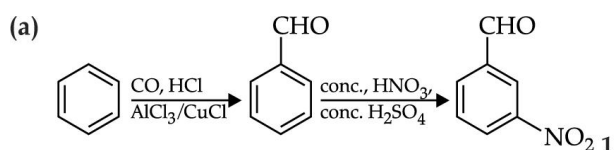
(b) The halogen atom because of its –I effect has some tendency to withdraw electrons from the benzene ring. As a result, the ring gets somewhat deactivated as compared to benzene and hence the electrophilic substitution reactions in haloarenes occur slowly and require more drastic conditions as compared to those in benzene. (1)

20.

(a) p-nitrobenzaldehyde is more reactive towards the nucleophilic addition reaction than p-tolualdehyde as Nitro group is electron withdrawing in nature. Presence of nitro group decrease electron density, hence facilitates the attack of nucleophile. Presence of $-\text{CH}_3$ leads to +I effect as $-\text{CH}_3$ is electron releasing group. (1)



OR



1

21. (a) Replication
A sequence of bases on DNA is unique for a person and is the genetic material transferred to the individual from the parent which helps in the determination of paternity. (1)

- (b) During denaturation secondary and tertiary structures are destroyed but the primary structure remains intact. (1)

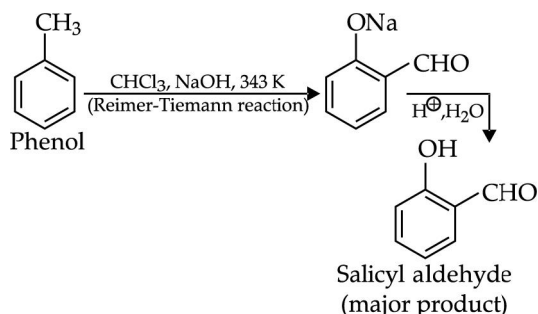
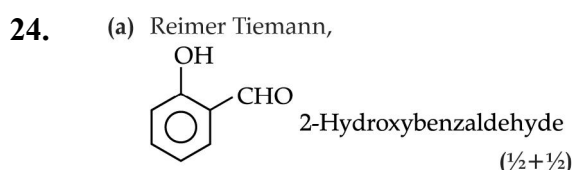
22. (a) $[\text{Cr}(\text{en})_2(\text{OH})_2]\text{Cl}$
or $[\text{Cr}(\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2)_2(\text{OH})_2]\text{Cl}$ (1)
(b) No, ionization isomers are possible by exchange of ligand with counter ion only and not by exchange of central metal ion. (1)

- (c) The central atom is electron pair acceptor so it is a Lewis acid. (1)

23. (a) Yes, if the concentration of ZnSO_4 in the two half cell is different, the electrode potential will be different making the cell possible. (1)

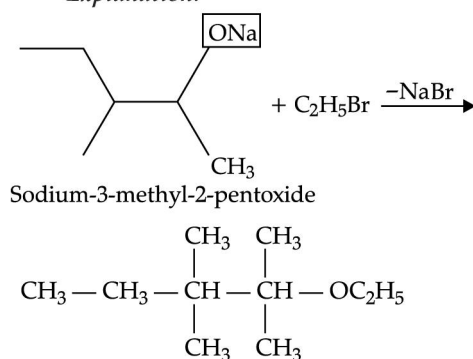
- (b) $\lambda_m^0(\text{MgCl}_2) = \lambda_m^0(\text{Mg}^{2+}) + 2\lambda_m^0(\text{Cl}^-)$
 $258.6 = 106 + 2\lambda_m^0(\text{Cl}^-)$
 $\lambda_m^0(\text{Cl}^-) = 76.3 \text{ Scm}^2\text{mol}^{-1}$ (1)

- (c) cell constant $G^* = k \times R$
 $k = \frac{G^*}{R} = \frac{0.146}{1000} = 1.46 \times 10^{-4} \text{ Scm}^{-1}$. (1)



- (b) Williamson synthesis, $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}(\text{CH}_3)\text{OC}_2\text{H}_5$
2-Ethoxy-3-methylpentane
($\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$)

Explanation:



- (c) Stephen reaction, $\text{CH}_3\text{CH}_2\text{CHO}$, Propanal
 $\text{CH}_3\text{CH}_2\text{CN} + [\text{H}] + \text{HCl} \xrightarrow[\text{H}_2\text{O}]{\text{Boiling}}$
 $\text{CH}_3\text{CH}_2\text{CHO} + \text{NH}_4\text{Cl}$
(Propanal) ($\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$)

25. A, B and C contain carbonyl group as they give positive 2,4 DNP test

A and B are aldehydes as aldehydes reduce Tollen's reagent

C is a ketone, as it contains carbonyl group but does not give positive Tollen's test ($\frac{1}{2}$)

C is a methyl ketone as it gives positive iodoform test ($\frac{1}{2}$)

B is an aldehyde that gives positive iodoform test ($\frac{1}{2}$)

D is a carboxylic acid
Since the number of carbons in the compounds A, B, C and D is three or two

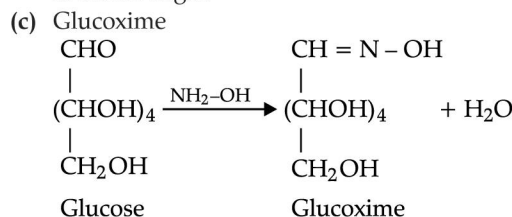
B is CH_3CHO as this is only aldehyde which gives a positive iodoform test ($\frac{1}{2}$)

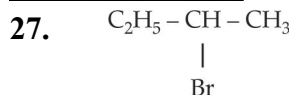
The remaining compounds A, C and D have three carbons

A is $\text{CH}_3\text{CH}_2\text{CHO}$, C is CH_3COCH_3 and D is $\text{CH}_3\text{CH}_2\text{COOH}$ ($\frac{1}{2}$ each)

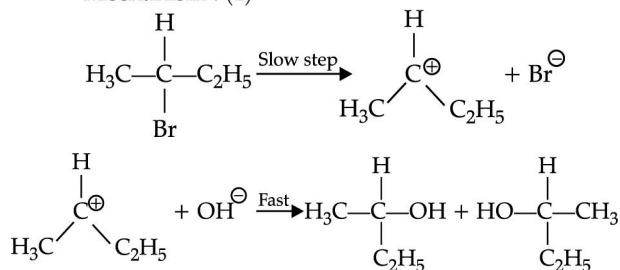
26. (a) The reactant Sucrose is dextrorotatory. On hydrolysis it give glucose dextrorotatory and fructose which is laevorotatory. The specific rotation of fructose is higher than glucose
Sucrose is dextrorotatory but after hydrolysis gives dextrorotatory glucose and laevorotatory fructose. Since the laevorotation of fructose (-92.4°) is more than dextrorotation of glucose ($+52.5^\circ$), the mixture is laevorotatory. (1)

- (b) Invert sugar. The hydrolysis of sucrose brings about a change in the sign of rotation, from dextro (+) to laevo (−) and the product is named as invert sugar. (1)





Mechanism : (1)



28. $\log\left(\frac{k_2}{k_1}\right) = \frac{E_a}{2.303R} \left[\frac{1}{T_1} - \frac{1}{T_2} \right]$

$$\log \frac{0.20}{0.02} = \frac{E_a}{2.303R} \left[\frac{1}{200} - \frac{1}{500} \right]$$

$$\log 10 = \frac{E_a}{19.15} \left(\frac{300}{200 \times 500} \right)$$

$$E_a = \frac{19.15 \times 200 \times 500}{300}$$

$$E_a = 6383.33 \text{ J/mol} \quad (1+1+1)$$

29. (a) D ligand cause maximum field splitting. Energy is directly proportional to the wave number. Maximum energy of light is required for an electron to jump from t_{2g} to e_g in case of $[\text{CrD}_6]^{3-}$ ($\frac{1}{2} + \frac{1}{2}$)

OR

A will be a weak field ligand. The splitting caused in least in this case as the energy required for electron to jump from t_{2g} to e_g , is minimum. ($\frac{1}{2} + \frac{1}{2}$)

- (b) $[\text{CrB}_6]^{3+}$ will be violet in colour. Wavelength of light absorbed is $\frac{1}{17830} = 560\text{nm}$ for the complex

while $\frac{1}{13640} = 733 \text{ nm}$ for $[\text{CrA}_6]^{3-}$ complex. ($\frac{1}{2} + \frac{1}{2}$)

- (c) (i) $[\text{CrCl}_6]^{3-}$, Hexachloridochromate(III) ion (1 each)
(ii) $[\text{Cr}(\text{NH}_3)_6]^{3+}$, Hexaamminechromium(III) ion
A = Cl^- , B = H_2O , C = NH_3 , D = CN^-

30. (a) 2mol e^- (or 2F) have been transferred from anode to cathode to consume 2 mol of H_2SO_4 therefore, one mole H_2SO_4 requires one faraday of electricity or 96500 coulombs.
(b) $w_{\text{max}} = -nFE^\circ = -2 \times 96500 \times 2.0 = 386000 \text{ J}$ of work can be extracted using lead storage cell when the cell is in use.
(c) Both yes and no should be accepted as correct answers depending upon what explanation is provided.

Yes, Hydrogen is a fuel that on combustion gives water as a by product. There are no carbon emissions and no pollutions caused.

However, at present the means to obtain hydrogen are electrolysis of water which use electricity obtained from fossil fuels and increase carbon emissions.

Inspite of the problems faced today in the extraction of hydrogen, we cannot disagree on the fact that hydrogen is a clean source of energy. Further research can help in finding solutions and greens ways like using solar energy for extraction of hydrogen. (2)

No. It is true that Hydrogen is a fuel that on combustion gives water as a byproduct. There are no carbon emissions and no pollutions caused.

However, at present the means to obtain hydrogen are electrolysis of water which use electricity obtained from fossil fuels and increase carbon emissions.

Hydrogen is no doubt a green fuel, but the process of extraction is not green as of today. At present, looking at the process of extraction, hydrogen is not a green fuel. (2)

OR

Both answers will be treated as correct

- (i) Lead batteries are currently the most important and widely used batteries. These are rechargeable. The problem is waste management which needs research and awareness. Currently, these are being thrown into landfills and there is no safe method of disposal or recycling. Research into safer method of disposal will reduce the pollution and health hazards caused to a great extent.

(1 mark for importance, 1 for need for the research)

- (ii) Fuel cell is a clean source of energy. Hydrogen undergoes combustion to produce water. The need of the hour is green fuel and hydrogen is a clean fuel. The current problem is obtaining hydrogen. Research that goes into this area will help solve the problem of pollution and will be a sustainable solution.

(1 mark for importance, 1 for need for the research)

31.

- (a) Both Ti^{3+} and Cu^{2+} have 1 unpaired electron, so the magnetic moment for both will be 1.73 BM
(b) Zn, it has a more negative electrode potential so will corrode itself in place of iron.
(c) Mn^+ has $3d^5 4s^1$ configuration and configuration of Cr^+ is $3d^5$, therefore, ionisation enthalpy of Mn^+ is lower than Cr^+ .
(d) Sc and Zn both form colourless compound and are diamagnetic.
(e) The decrease in the atomic and ionic radii with increase in atomic number of actinoids due to poor shielding effect of 5f electron.

(f) In both chromate and dichromate ion the oxidation state of Cr is +6



(1 each, any 5)

32.

(a) Addition of glucose to water is an endothermic reaction. According to Le Chatelier's principle, on increase in temperature, solubility will increase.

(b) Q is ocean water, due to the presence of salts it freezes at lower temperature (depression in freezing point)

(c) $\text{K}_3[\text{Fe}(\text{CN})_6]$ gives 4 ions in aqueous solution (½)

$$i = 1 + (n - 1)\alpha$$

$$i = 1 + (4 - 1) \times 0.852$$

$$i = 3.556$$

(½)

$$\Delta T_b = iK_b m = 3.556 \times 0.52 \times 1 = 1.849$$

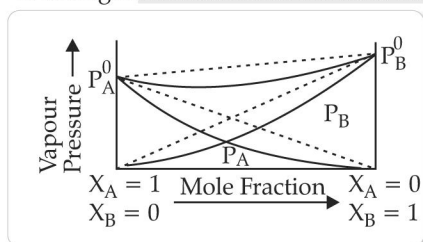
(1)

$$T_b = 273.15 + 1.849 = 274.99 \text{ K}$$

(½)

OR

(a) Negative Deviation is expected when phenol and aniline are mixed with each other. The net volume of the mixture will decrease, $\Delta V < 0$ due to stronger intermolecular interactions. (1)



(b) Relative lowering of vapour pressure = $\frac{(P^\circ - P)}{P^\circ}$

$$= x_2 = \frac{n_2}{n_1}$$

$$n_2 = 0.1$$

$$n_1 = 100/18$$

$$x_2 = \frac{0.1}{5.55 + 0.1} = \frac{0.1}{5.65} = 0.018$$

(½)

$$P^\circ = 23.8 \text{ mm Hg}$$

$$\text{Relative lowering of vapour pressure} = \frac{(23.80 - P)}{23.80} = 0.018$$

(½)

$$23.80 - P = 0.428$$

(½)

$$P = 23.80 - 0.428 = 23.37 \text{ mm Hg}$$

(1)

33.

Compound "A" is p-methylnitrobenzene

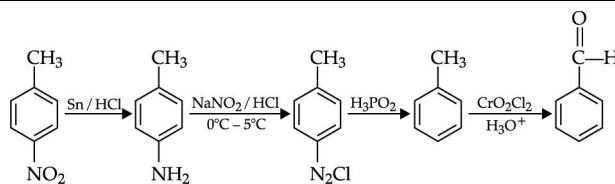
Compound "B" is p-methylbenzenamine

Compound C is p-methylbenzenediazoniumchloride

Compound D - Toluene

Compound E - Benzaldehyde

The chemical reactions involved are



(1 mark for correct identification of A, 1 each for identification and reaction of formation of B, C, D and E from A)

OR

(a) (i) The hydrogen attached to N-Ethylbenzene sulphonamide is acidic in nature. This is due to the presence of strong electron withdrawing sulphonyl group. Hence, it is soluble in alkali. (1)

(ii) Reduction with iron scrap and hydrochloric acid is preferred because FeCl_2 formed gets hydrolysed to release hydrochloric acid during the reaction. Thus, only a small amount of hydrochloric acid is required to initiate the reaction. (1)

(b) (i) $\text{C}_6\text{H}_5\text{NH}_2 > \text{C}_6\text{H}_5\text{NHCH}_3 > \text{NH}_3 > \text{C}_6\text{H}_5\text{CH}_2\text{NH}_2 > \text{CH}_3\text{NH}_2$ (1)

(ii) $\text{C}_2\text{H}_5\text{Cl} < \text{C}_2\text{H}_5\text{NH}_2 < \text{C}_2\text{H}_5\text{OH}$ (1)

(iii) $\text{CH}_3\text{COOH} > \text{C}_2\text{H}_5\text{OH} > \text{CH}_3\text{NH}_2 > \text{CH}_3\text{OCH}_3$ (1)