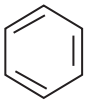
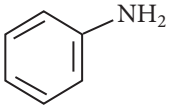
NEET 2022

SOLVED PAPER

SECTION - A

1. Identify the incorrect statement from the following.
(a) Alkali metals react with water to form their hydroxides.
(b) The oxidation number of K in KO_2 is +4.
(c) Ionisation enthalpy of alkali metals decreases from top to bottom in the group.
(d) Lithium is the strongest reducing agent among the alkali metals.

2. The IUPAC name of an element with atomic number 119 is
(a) ununennium (b) unnilennium
(c) unununnium (d) ununoctium.

3. Which of the following is suitable to synthesize chlorobenzene?
(a) Benzene, Cl_2, anhydrous $AlCl_3$
(b) Phenol, $NaNO_2$, HCl, CuCl
(c)  , HCl
(d)  , HCl, heating

4. Match List-I with List-II.

List-I		List-II	
(A)	Li	(i)	absorbent for carbon dioxide
(B)	Na	(ii)	electrochemical cells
(C)	KOH	(iii)	coolant in fast breeder reactors
(D)	Cs	(iv)	photoelectric cell

Choose the correct answer from the options given below:
(a) (A) -(iv), (B) - (i), (C) - (iii), (D) - (ii)
(b) (A) -(iii), (B) - (iv), (C) - (ii), (D) - (i)
(c) (A) -(i), (B) - (iii), (C) - (iv), (D) - (ii)
(d) (A) -(ii), (B) - (iii), (C) - (i), (D) - (iv)

5. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : ICl is more reactive than I_2.
Reason (R) : I — Cl bond is weaker than I — I bond.
In the light of the above statements, choose the most appropriate answer from the options given below:
(a) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(b) Both (A) and (R) are correct but (R) is not the correct explanation of (A).
(c) (A) is correct but (R) is not correct.
(d) (A) is not correct but (R) is correct.

6. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : In a particular point defect, an ionic solid is electrically neutral, even if few of its cations are missing from its unit cell.
Reason (R) : In an ionic solid, Frenkel defect arises due to dislocation of cation from its lattice site to interstitial site, maintaining overall electrical neutrality.
In the light of the above statements, choose the most appropriate answer from the options given below:
(a) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(b) Both (A) and (R) are correct but (R) is not the correct explanation of (A).
(c) (A) is correct but (R) is not correct.
(d) (A) is not correct but (R) is correct.

7. Given below are two statements:
Statement-I : The boiling points of aldehydes and ketones are higher than hydrocarbons of comparable molecular masses because of weak molecular association in aldehydes and ketones due to dipole-dipole interactions.
Statement-II : The boiling points of aldehydes and ketones are lower than the alcohols of similar molecular masses due to the absence of H-bonding.
In the light of the above statements, choose the most appropriate answer from the options given below:
(a) Both statement-I and statement-II are correct.
(b) Both statement-I and statement-II are incorrect.
(c) Statement-I is correct but statement-II is incorrect.
(d) Statement-I is incorrect but statement-II is correct.

8. Choose the correct statement.
(a) Diamond and graphite have two dimensional network.
(b) Diamond is covalent and graphite is ionic.

(c) Diamond is sp^3 hybridised and graphite is sp^2 hybridised.
(d) Both diamond and graphite are used as lubricants.

9. Match List-I with List-II.

List-I (Drug class)		List-II (Drug molecule)	
(A)	Antacids	(i)	Salvarsan
(B)	Antihistamines	(ii)	Morphine
(C)	Analgesics	(iii)	Cimetidine
(D)	Antimicrobials	(iv)	Seldane

Choose the correct answer from the options given below:
(a) (A) -(iii), (B) - (ii), (C) - (iv), (D) - (i)
(b) (A) -(iii), (B) - (iv), (C) - (ii), (D) - (i)
(c) (A) -(i), (B) - (iv), (C) - (ii), (D) - (iii)
(d) (A) -(iv), (B) - (iii), (C) - (i), (D) - (ii)

10. Match List-I with List-II.

List-I (Products formed)		List-II (Reaction of carbonyl compound with)	
(A)	Cyanohydrin	(i)	NH_2OH
(B)	Acetal	(ii)	RNH_2
(C)	Schiff's base	(iii)	Alcohol
(D)	Oxime	(iv)	HCN

Choose the correct answer from the options given below:
(a) (A) -(iii), (B) - (iv), (C) - (ii), (D) - (i)
(b) (A) -(ii), (B) - (iii), (C) - (iv), (D) - (i)
(c) (A) -(i), (B) - (iii), (C) - (ii), (D) - (iv)
(d) (A) -(iv), (B) - (iii), (C) - (ii), (D) - (i)

11. Given below are two statements:
Statement-I : Primary aliphatic amines react with HNO_2 to give unstable diazonium salts.
Statement-II : Primary aromatic amines react with HNO_2 to form diazonium salts which are stable even above 300 K.
In the light of the above statements, choose the most appropriate answer from the options given below:
(a) Both statement-I and statement-II are correct.
(b) Both statement-I and statement-II are incorrect.
(c) Statement-I is correct but statement-II is incorrect.
(d) Statement-I is incorrect but statement-II is correct.

12. Given below are two statements:
Statement-I : In the coagulation of a negative sol, the flocculating power of the three given ions is in the order : $Al^{3+} > Ba^{2+} > Na^+$.
Statement-II : In the coagulation of a positive sol, the flocculating power of the three given salts is in the order : $NaCl > Na_2SO_4 > Na_3PO_4$.
In the light of the above statements, choose the most appropriate answer from the options given below:
(a) Both statement-I and statement-II are correct.
(b) Both statement-I and statement-II are incorrect.
(c) Statement-I is correct but statement-II is incorrect.
(d) Statement-I is incorrect but statement-II is correct.

13. Given below are two statements:
Statement-I : The boiling points of the following hydrides of group 16 elements increases in the order: $H_2O < H_2S < H_2Se < H_2Te$.
Statement-II : The boiling points of these hydrides increase with increase in molecular mass.
In the light of the above statements, choose the most appropriate answer from the options given below:
(a) Both statement-I and statement-II are correct.
(b) Both statement-I and statement-II are incorrect.
(c) Statement-I is correct but statement-II is incorrect.
(d) Statement-I is incorrect but statement-II is correct.

14. In one molal solution that contains 0.5 mole of a solute, there is
(a) 500 mL of solvent (b) 500 g of solvent
(c) 100 mL of solvent (d) 1000 g of solvent.

15. Which of the following statements is not correct about diborane?
(a) There are two 3-centre-2-electron bonds.
(b) The four terminal B – H bonds are two centre two electron bonds.
(c) The four terminal hydrogen atoms and the two boron atoms lie in one plane.
(d) Both the boron atoms are sp^2 hybridised.

16. Match List-I with List-II.

List-I (Hydrides)		List-II (Nature)	
(A)	MgH_2	(i)	Electron precise
(B)	GeH_4	(ii)	Electron deficient
(C)	B_2H_6	(iii)	Electron rich
(D)	HF	(iv)	Ionic

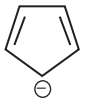
Choose the correct answer from the options given below:
(a) (A) -(iv), (B) - (i), (C) - (ii), (D) - (iii)
(b) (A) -(iii), (B) - (i), (C) - (ii), (D) - (iv)
(c) (A) -(i), (B) - (ii), (C) - (iv), (D) - (iii)
(d) (A) -(ii), (B) - (iii), (C) - (iv), (D) - (i)

17. The incorrect statement regarding chirality is
(a) S_N1 reaction yields 1 : 1 mixture of both enantiomers
(b) the product obtained by S_N2 reaction of haloalkane having chirality at the reactive site shows inversion of configuration
(c) enantiomers are superimposable mirror images of each other
(d) a racemic mixture shows zero optical rotation.

18. The pH of the solution containing 50 mL each of 0.10 M sodium acetate and 0.01 M acetic acid is
[Given : pK_a of $CH_3COOH = 4.57$]
(a) 5.57 (b) 3.57 (c) 4.57 (d) 2.57

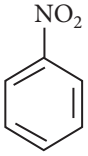
19. The IUPAC name of the complex $[Ag(H_2O)_2][Ag(CN)_2]$ is
(a) dicyanidosilver(II) diaquaargentate(II)
(b) diaquasilver(II)dicyanidoargentate(II)
(c) dicyanidosilver(I) diaquaargentate(I)
(d) diaquasilver(I)dicyanidoargentate(I).

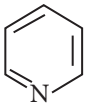
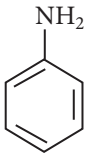
20. Which compound amongst the following is not an aromatic compound?

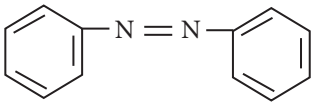
(a)  (b) 

(c)  (d) 

21. The Kjeldahl's method for the estimation of nitrogen can be used to estimate the amount of nitrogen in which one of the following compounds?

(a) 

(b)  (c) 

(d) 

22. The incorrect statement regarding enzymes is
(a) enzymes are biocatalysts
(b) like chemical catalysts enzymes reduce the activation energy of bio processes
(c) enzymes are polysaccharides
(d) enzymes are very specific for a particular reaction and substrate.

23. Gadolinium has a low value of third ionisation enthalpy because of
(a) small size (b) high exchange enthalpy
(c) high electronegativity (d) high basic character.

24. Which amongst the following is incorrect statement?
(a) The bond orders of O_2^+, O_2, O_2^- and O_2^{2-} are 2.5, 2, 1.5 and 1, respectively.
(b) C_2 molecule has four electrons in its two degenerate π molecular orbitals.
(c) H_2^+ ion has one electron.
(d) O_2^+ ion is diamagnetic.

25. Given below are half-cell reactions:

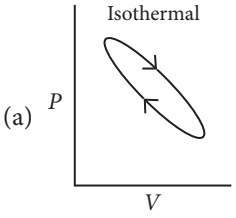
$MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$;

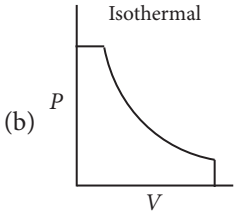
$E^\circ_{Mn^{2+}/MnO_4^-} = -1.510$ V

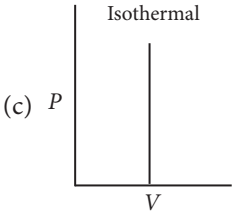
$\frac{1}{2} O_2 + 2H^+ + 2e^- \longrightarrow H_2O$; $E^\circ_{O_2/H_2O} = +1.223$ V

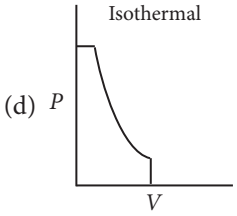
Will the permanganate ion, MnO_4^- liberate O_2 from water in the presence of an acid?
(a) Yes, because $E^\circ_{cell} = +0.287$ V
(b) No, because $E^\circ_{cell} = -0.287$ V
(c) Yes, because $E^\circ_{cell} = +2.733$ V
(d) No, because $E^\circ_{cell} = -2.733$ V

26. Which of the following *P-V* curve represents maximum work done?

(a) 

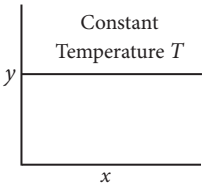
(b) 

(c) 

(d) 

27. Given below are two statements:
Statement-I : The acidic strength of monosubstituted nitrophenol is higher than phenol because of electron withdrawing nitro group.
Statement-II : *o*-Nitrophenol, *m*-nitrophenol and *p*-nitrophenol will have same acidic strength as they have one nitro group attached to the phenolic ring.
In the light of the above statements, choose the most appropriate answer from the options given below:
(a) Both statement-I and statement-II are correct.
(b) Both statement-I and statement-II are incorrect.
(c) Statement-I is correct but statement-II is incorrect.
(d) Statement-I is incorrect but statement-II is correct.

28. The given graph is a representation of kinetics of a reaction.



The *y* and *x* axes for zero and first order reactions, respectively are
(a) zero order (*y* = concentration and *x* = time), first order ($y = t_{1/2}$ and *x* = concentration)
(b) zero order (*y* = concentration and *x* = time), first order (*y* = rate constant and *x* = concentration)
(c) zero order (*y* = rate and *x* = concentration), first order ($y = t_{1/2}$ and *x* = concentration)
(d) zero order (*y* = rate and *x* = concentration), first order (y = rate and $x = t_{1/2}$)

29. Identify the incorrect statement from the following.
(a) All the five 5*d* orbitals are different in size when compared to the respective 4*d* orbitals.
(b) All the five 4*d* orbitals have shapes similar to the respective 3*d* orbitals.
(c) In an atom, all the five 3*d* orbitals are equal in energy in free state.
(d) The shapes of d_{xy}, d_{yz} and d_{zx} orbitals similar to each other; and $d_{x^2-y^2}$ and d_{z^2} are similar to each other.

30. $RMgX + CO_2 \xrightarrow[\text{ether}]{\text{dry}} Y \xrightarrow{H_3O^+} RCOOH$

What is *Y* in the above reaction?
(a) $RCOO^-Mg^+X$ (b) $R_3CO^-Mg^+X$
(c) $RCOO^-X^+$ (d) $(RCOO)_2Mg$

31. Amongst the following which one will have maximum lone pair-lone pair electron repulsions?
(a) ClF_3 (b) IF_5 (c) SF_4 (d) XeF_2

32. Which one is not correct mathematical equation for Dalton's Law of partial pressure? Here p = total pressure of gaseous mixture

(a) $p = p_1 + p_2 + p_3$

(b) $p = n_1\frac{RT}{V} + n_2\frac{RT}{V} + n_3\frac{RT}{V}$

(c) $p_i = x_i p$, where p_i = partial pressure of i^{th} gas
x_i = mole fraction of i^{th} gas in gaseous mixture

(d) $p_i = x_i p_i^\circ$, where x_i = mole fraction of i^{th} gas in gaseous mixture, p_i° = pressure of i^{th} gas in pure state

33. Which statement regarding polymers is not correct?

(a) Elastomers have polymer chains held together by weak intermolecular forces.

(b) Fibres possess high tensile strength.

(c) Thermoplastic polymers are capable of repeatedly softening and hardening on heating and cooling respectively.

(d) Thermosetting polymers are reusable.

34. What mass of 95% pure $CaCO_3$ will be required to neutralise 50 mL of 0.5 M HCl solution according to the following reaction?

$CaCO_{3(s)} + 2HCl_{(aq)} \longrightarrow CaCl_{2(aq)} + CO_{2(g)} + 2H_2O_{(l)}$

(Calculate upto second place of decimal point.)

(a) 1.25 g (b) 1.32 g (c) 3.65 g (d) 9.50 g

35. At 298 K the standard electrode potentials of $Cu^{2+}/Cu, Zn^{2+}/Zn, Fe^{2+}/Fe$ and Ag^{+}/Ag are 0.34 V, – 0.76 V, – 0.44 V and 0.80 V respectively.

On the basis of standard electrode potential, predict which of the following reaction cannot occur?

(a) $CuSO_{4(aq)} + Zn_{(s)} \longrightarrow ZnSO_{4(aq)} + Cu_{(s)}$

(b) $CuSO_{4(aq)} + Fe_{(s)} \longrightarrow FeSO_{4(aq)} + Cu_{(s)}$

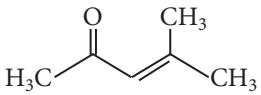
(c) $FeSO_{4(aq)} + Zn_{(s)} \longrightarrow ZnSO_{4(aq)} + Fe_{(s)}$

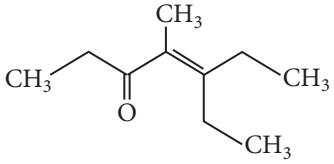
(d) $2CuSO_{4(aq)} + 2Ag_{(s)} \longrightarrow 2Cu_{(s)} + Ag_2SO_{4(aq)}$

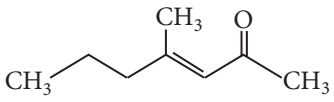
SECTION - B

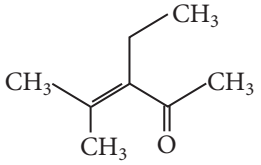
Attempt any 10 questions out of 15.

36. Which one of the following is not formed when acetone reacts with 2-pentanone in the presence of dilute NaOH followed by heating?

(a) 

(b) 

(c) 

(d) 

37. For a first order reaction $A \longrightarrow$ Products, initial concentration of A is 0.1 M, which becomes 0.001 M after 5 minutes. Rate constant for the reaction in min^{-1} is

(a) 1.3818 (b) 0.9212 (c) 0.4606 (d) 0.2303

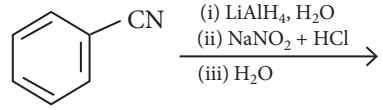
38. $3O_{2(g)} \rightleftharpoons 2O_{3(g)}$

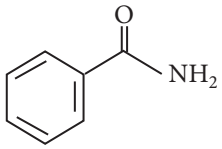
For the above reaction at 298 K, K_c is found to be 3.0×10^{-59}. If the concentration of O_2 at equilibrium is 0.040 M then concentration of O_3 in M is

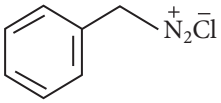
(a) 4.38×10^{-32} (b) 1.9×10^{-63}

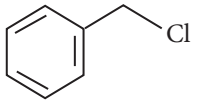
(c) 2.4×10^{31} (d) 1.2×10^{21}

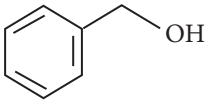
39. The product formed from the following reaction sequence is



(a) 

(b) 

(c) 

(d) 

40. Match List-I with List-II.

List -I (Ores)		List-II (Composition)	
(A)	Haematite	(i)	Fe_3O_4
(B)	Magnetite	(ii)	$ZnCO_3$
(C)	Calamine	(iii)	Fe_2O_3
(D)	Kaolinite	(iv)	$[Al_2(OH)_4Si_2O_5]$

Choose the correct answer from the options given below :

(a) (A) -(i), (B) -(ii), (C) -(iii), (D) -(iv)

(b) (A) -(iii), (B) -(i), (C) -(ii), (D) -(iv)

(c) (A) -(iii), (B) -(i), (C) -(iv), (D) -(ii)

(d) (A) -(i), (B) -(iii), (C) -(ii), (D) -(iv)

41. Given below are two statements :

Statement I : In Lucas test, primary, secondary and tertiary alcohols are distinguished on the basis of their reactivity with conc. HCl + $ZnCl_2$, known as Lucas Reagent.

Statement II : Primary alcohols are most reactive and immediately produced turbidity at room temperature on reaction with Lucas Reagent.

In the light of the above statements, choose the most appropriate answer from the options given below.

(a) Both statement I and statement II are correct.

(b) Both statement I and statement II are incorrect.

(c) Statement I is correct but statement II is incorrect.

(d) Statement I is incorrect but statement II is correct.

42. Find the emf of the cell in which following reaction takes place at 298 K.

$Ni_{(s)} + 2Ag^{+}$ (0.001 M) $\longrightarrow Ni^{2+}$ (0.001 M) + $2Ag_{(s)}$

Given that E°_{cell} = 10.5 V, $\frac{2.303RT}{F} = 0.059$ at 298 K)

(a) 1.0385 V (b) 1.385 V (c) 0.9615 V (d) 1.05 V

43. Compound *X* on reaction with O_3 followed by Zn/H_2O gives formaldehyde and 2-methylpropanal as products. The compound *X* is
(a) 3-methylbut-1-ene (b) 2-methylbut-1-ene
(c) 2-methylbut-2-ene (d) pent-2-ene.

44. In the neutral or faintly alkaline medium $KMnO_4$ oxidises iodide into iodate. The change in oxidation state of manganese in this reaction is from
(a) +7 to +4 (b) +6 to +4
(c) +7 to +3 (d) +6 to +5

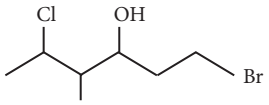
45. Copper crystallises in *fcc* unit cell with cell edge length of 3.608×10^{-8} cm. The density of copper is 8.92 g cm^{-3}. Calculate the atomic mass of copper.
(a) 63.1 u (b) 31.55 u (c) 60 u (d) 65 u

46. A 10.0 L flask contains 64 g of oxygen at 27°C. (Assume O_2 gas is behaving ideally). The pressure inside the flask in bar is
(Given $R = 0.0831$ L bar K^{-1} mol^{-1})
(a) 2.5 (b) 498.6 (c) 49.8 (d) 4.9

47. If radius of second Bohr orbit of the He^+ ion is 105.8 pm, what is the radius of third Bohr orbit of Li^{2+} ion?
(a) 158.7 pm (b) 15.87 pm
(c) 1.587 pm (d) 158.7 Å

48. The order of energy absorbed which is responsible for the colour of complexes
(*A*) $[Ni(H_2O)_2(en)_2]^{2+}$ (*B*) $[Ni(H_2O)_4(en)]^{2+}$ and
(*C*) $[Ni(en)_3]^{2+}$
is
(a) (*A*) > (*B*) > (*C*) (b) (*C*) > (*B*) > (*A*)
(c) (*C*) > (*A*) > (*B*) (d) (*B*) > (*A*) > (*C*)

49. The correct IUPAC name of the following compound is



(a) 1-bromo-5-chloro-4-methylhexan-3-ol
(b) 6-bromo-2-chloro-4-methylhexan-4-ol
(c) 1-bromo-4-methyl-5-chlorohexan-3-ol
(d) 6-bromo-4-methyl-2-chlorohexan-4-ol.

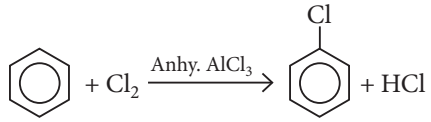
50. The pollution due to oxides of sulphur gets enhanced due to the presence of
(*A*) particulate matter
(*B*) ozone
(*C*) hydrocarbons
(*D*) hydrogen peroxide
Choose the most appropriate answer from the options given below :
(a) (*A*), (*D*) only (b) (*A*), (*B*), (*D*) only
(c) (*B*), (*C*), (*D*) only (d) (*A*), (*C*), (*D*) only

HINTS & SOLUTIONS

1. (b) : The superoxide species (KO_2) is represented as O_2^-, since the compound is neutral, therefore the oxidation state of potassium is +1. Remaining all the given statements are correct.

2. (a) : The IUPAC name of an element with atomic number 119 is ununennium.

3. (a) : Arenes react with halogens in the presence of a Lewis acid like anhydrous $FeCl_3$, $FeBr_3$ or $AlCl_3$ to yield haloarenes, *e.g.*,



4. (d) :

Element/Compound	Uses
Li	Electrochemical Cells
Na	Coolant in fast breeder reactors
KOH	Absorbent for carbon dioxide
Cs	Photoelectric cell

5. (a) : In general, interhalogen compounds are more reactive than halogens (except fluorine). This is because *X*–*X*′ (ICl) bond in interhalogens is weaker than *X*–*X* (I–I) bond in halogens except F–F bond.

6. (b) : Frenkel defect is shown by ionic solids. The smaller ion (usually cation) is dislocated from its normal site to an interstitial site. It creates a vacancy defect at its original site and an interstitial defect at its new location.

7. (a) : Both the given statements are correct.

8. (c) : In diamond each carbon atom undergoes sp^3 hybridisation and linked to four other carbon atoms by using hybridised orbitals in tetrahedral fashion. In graphite, each carbon atom in hexagonal ring undergoes sp^2 hybridisation and make three sigma bonds with three neighbouring carbon atoms. Fourth electron forms a π-bond.

9. (b) : Antacids (A) - Cimetidine (iii)
Antihistamines (B) - Seldane (iv)
Analgesics (C) - Morphine (ii)
Antimicrobial (D) - Salvarsan (i)

10. (d) : Aldehydes react with HCN to give cyanohydrin.
Aldehydes react with alcohol to form acetal.
Aldehydes react with amine to give Schiff's base.
Aldehydes react with NH_2OH to give oxime.

11. (c) : Primary aliphatic amines react with nitrous acid to form aliphatic diazonium salts which are unstable while aromatic amines react with nitrous acid at low temperature (273-278 K) to form diazonium salts, a very important class of compounds used for synthesis of a variety of aromatic compounds.

12. (c) : In the coagulation of a positive sol, the flocculating power is in the order : $PO_4^{3-} > SO_4^{2-} > Cl^-$
or, $NaCl < Na_2SO_4 < Na_3PO_4$

13. (b) :

	H_2O	H_2S	H_2Se	H_2Te
B.pt. :	373 K	213 K	232 K	269 K

14. (b) : Molality $(m) = \dfrac{\text{Number of moles of solute}}{\text{Mass of solvent in kg}}$
Let amount of solvent be x g.

$$1 = \frac{0.5}{\frac{x}{1000}} \; ; x = 500 \text{ g}$$

15. (d) : In diborane (B_2H_6), each boron (B) atom uses sp^3 hybrid orbitals for bonding.

16. (a) : MgH_2 - Ionic hydride
GeH_4 - Electron precise hydride
B_2H_6 - Electron deficient hydride
HF - Electron rich hydride

17. (c) : Enantiomers are non-superimposable mirror images of each other. Enantiomers possess identical physical properties namely, melting point, boiling point, refractive index, etc. They only differ with respect to the rotation of plane polarised light. If one of the enantiomer is dextrorotatory, then other will be laevorotatory.

18. (a) : It is an acidic buffer.
For acidic buffer,

$$\text{pH} = \text{p}K_a + \log \frac{[\text{Salt}]}{[\text{Acid}]}$$
$$= 4.57 + \log \frac{0.1}{0.01}$$
$$= 4.57 + \log 10 = 4.57 + 1 = 5.57$$

19. (d)

20. (d) : Compound (d) is not an aromatic compound as reflected by the non planarity of the methylene bridge (—CH_2—) with respect to other atoms. However, tropylium cation is aromatic due to planarity.

21. (c) : Kjeldahl method is not applicable to compounds containing nitrogen in nitro group, azo groups and nitrogen present in the ring (*e.g.*, pyridine).

22. (c) : Enzymes are protein molecules of high molecular mass and form colloidal solutions in water.

23. (b) : Due to high exchange enthalpy, $Gd^{3+}(4f^7)$ acquires extra stability and has low third ionisation enthalpy.

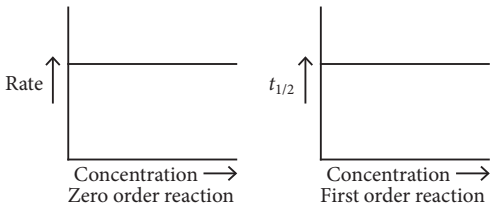
24. (d) : $O_2^+ : \sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \sigma 2p_z^2 \pi 2p_x^2 = \pi 2p_y^2 \pi^* 2p_x^1$
Due to the presence of one unpaired electron, O_2^+ is paramagnetic in nature.

25. (a) : $E^\circ_{cell} = E^\circ_{cathode} - E^\circ_{anode}$
$= 1.510 - 1.223 = +0.287$
As E°_{cell} is positive, hence the reaction is feasible.

26. (b)

27. (c) : Electron withdrawing groups (*e.g.* $-NO_2$) stabilise the phenoxide ion more by dispersing the negative charge relative to phenol (*i.e.*, release of proton becomes easy) and thus, increase the acidic strength of phenols. The particular effect is more when the substituent is present on *o*- and *p*-positions than in *m*-position to the phenolic group. Thus, acidic strength of nitrophenols decreases in the order :
p-nitrophenol > *o*-nitrophenol > *m*-nitrophenol > phenol.

28. (c) :



29. (d) : The shapes of d_{xy}, d_{yz}, d_{xz} and $d_{x^2-y^2}$ are similar to each other, whereas that of d_{z^2} is different from others. All five 3*d*-orbitals are equivalent in energy. The *d*-orbitals for which *n* is greater than 3 (4*d*, 5*d*, ...) also have shapes similar to 3*d*-orbital but differ in energy and size.

30. (a) :

$$R\text{Mg}X + CO_2 \xrightarrow{\text{Dry ether}} R-C(=O)-\underset{(Y)}{O^-\,\overset{+}{}\,\text{Mg}X} \xrightarrow{H_3O^+} R-C(=O)-OH$$

31. (d) : ClF_3, IF_5, SF_4 and XeF_2 contain 2, 1, 1 and 3 lone pairs of electrons on the central atom respectively. Hence, XeF_2 has maximum lone pair-lone pair repulsions.

32. (d)

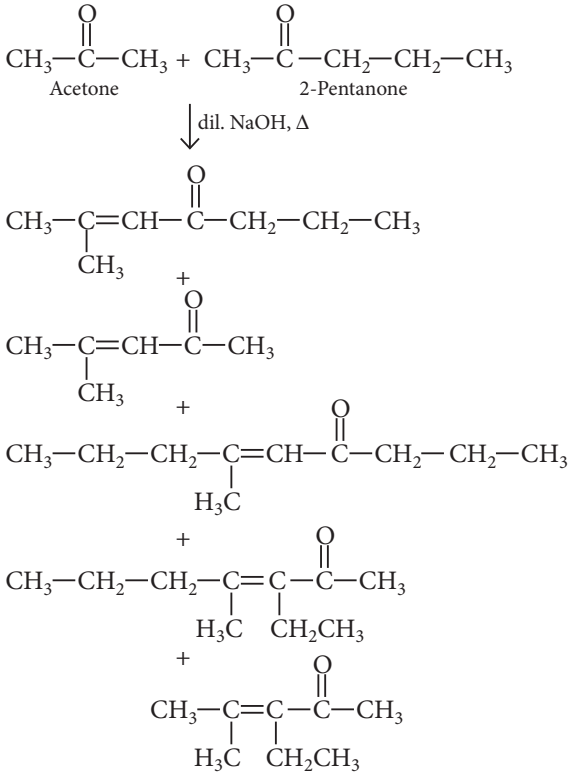
33. (d) : Thermosetting polymers on heating undergoes extensive cross-linking and becomes infusible. Hence, these cannot be reused.

34. (b) : Volume of HCl = 50 mL = 0.05 L
Molarity of HCl = 0.5 M
$\therefore$ Moles of HCl = $0.05 \times 0.5 = 0.025$ moles
$CaCO_3 + 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O$
For 2 moles of HCl, $CaCO_3$ required = 1 mole
$\therefore$ For 0.025 moles of HCl, $CaCO_3$ required = $\dfrac{0.025}{2}$ moles
Mass of $CaCO_3$ required = $100 \times \dfrac{0.025}{2} = 1.25$ g
For 95% pure $CaCO_3$, mass of $CaCO_3$ required
$= \dfrac{1.25}{95} \times 100 \text{ g} = 1.315 \text{ g} \approx 1.32 \text{ g}$

35. (d) : The values of standard reduction potential of Cu and Ag suggest that Cu would undergo oxidation (lower reduction potential) and Ag would undergoes reduction (higher reduction potential). Hence, the feasible cell reaction will be

$$Cu + 2Ag^+ \longrightarrow Cu^{2+} + 2Ag$$

36. (b) : When acetone reacts with 2-pentanone in the presence of dil. NaOH, following products are formed:



37. (b) : For a first order reaction,

$$k = \frac{2.303}{t}\log\frac{a}{a-x}\ ;\ k = \frac{2.303}{5}\log\frac{0.1}{0.001}$$

$$k = \frac{2.303}{5}\log 10^2 = \frac{2.303\times 2}{5} = 0.9212\ \text{min}^{-1}$$

38. (a) : $3O_{2(g)} \rightleftharpoons 2O_{3(g)}$

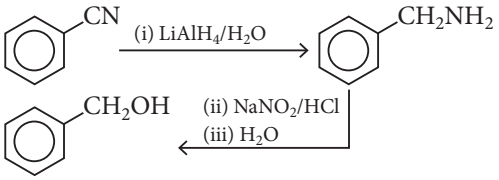
Initial conc.	1	0
At equilibrium	$1-3x$	$2x$

$$K_c = \frac{[O_3]^2}{[O_2]^3} = 3\times 10^{-59}$$

Given, $[O_2] = 0.040$ M ; $K_c = \frac{[O_3]^2}{(0.040)^3} = 3\times 10^{-59}$

$[O_3]^2 = 1.92 \times 10^{-63}$; $[O_3] = 4.38 \times 10^{-32}$ M

39. (d) :



40. (b) : Haematite - Fe_2O_3
Magnetite - Fe_3O_4
Calamine - $ZnCO_3$
Kaolinite - $Al_2O_3{\cdot}2SiO_2{\cdot}2H_2O$

41. (c) : Tertiary alcohols are most reactive and immediately produce turbidity at room temperature while primary alcohols do not react with Lucas reagent at room temperature.

42. (c) : According to Nernst equation,

$$E = E^\circ_{cell} - \frac{0.059}{n}\log\frac{[Ni^{2+}]}{[Ag^+]^2}\ ;\ E^\circ_{cell} = 1.05 \text{ (Given)}$$

Note : Please read 10.5 as 1.05 in question.

$$E = 1.05 - \frac{0.059}{2}\log\frac{(0.001)}{(0.001)^2} = 1.05 - \frac{0.059}{2}\log 10^3$$

$$= 1.05 - \frac{0.059\times 3}{2} = 1.05 - 0.0885 = 0.9615\ \text{V}$$

43. (a) : Given, $X + O_3 \xrightarrow{Zn/H_2O}$ HCHO + $CH_3{-}\underset{CH_3}{\underset{|}{CH}}{-}CHO$
Formaldehyde 2-Methylpropanal

So, X can be

$\overset{4}{C}H_3 - \underset{CH_3}{\overset{3}{\underset{|}{C}}}H - \overset{2}{C}H = \overset{1}{C}H_2$

3-Methylbut-1-ene

44. (a) : Reaction of MnO_4^- with I^- in neutral or faintly alkaline solution :

$$\overset{+7}{2MnO_4^-} + H_2O + \overset{-1}{I^-} \longrightarrow \overset{+4}{2MnO_2} + 2OH^- + \overset{+5}{IO_3^-}$$

45. (a) : Density of unit cell, $d = \frac{Z\times M}{N_0\times a^3}$

Given, $a = 3.608 \times 10^{-8}$ cm
$d = 8.92$ g/cm^3; $Z = 4$ (for *fcc*)

$$M = \frac{N_0\times a^3\times d}{Z} = \frac{6.023\times 10^{23}\times(3.608\times 10^{-8})^3\times 8.92}{4}$$

$$= 63.08\ \text{u} \approx 63.1\ \text{u}$$

46. (d) : $V = 10$ L
Mass of $O_2 = 64$ g; $T = 300$ K
According to ideal gas equation, $PV = nRT$

$$P = \frac{nRT}{V} = \frac{64}{32}\times\frac{0.0831\times 300}{10}\ ;\ P = 4.986\ \text{bar}$$

47. (a) : Radius = $r_0 \times \frac{n^2}{Z}$

For He^+, $n = 2$; $Z = 2$; $r_{He^+} = r_0 \times \frac{2\times 2}{2}$; $105.8 = r_0 \times 2$;

$r_0 = \frac{105.8}{2}$ pm

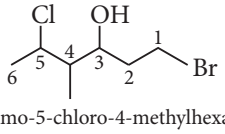
For Li^{2+}, $n = 3$; $Z = 3$

$$r_{Li^{2+}} = r_0 \times \frac{(3)^2}{3} = \frac{105.8}{2}\times 3 = 158.7\ \text{pm or } 1.587\ \text{Å}$$

48. (c) : Chelating ligand increases the stability of complex compound and higher the number of chelating ligands, higher will be the stability. Higher is the strength of the ligand, higher is the amount of energy absorbed by the complex.
Hence, order is

$$\underset{(C)}{[Ni(en)_3]^{2+}} > \underset{(A)}{[Ni(H_2O)_2(en)_2]^{2+}} > \underset{(B)}{[Ni(H_2O)_4(en)]^{2+}}$$

49. (a) :



1-Bromo-5-chloro-4-methylhexan-3-ol

50. (b) : The presence of particulate matter in polluted air catalyses the oxidation of sulphur dioxide to sulphur trioxide.
$2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)}$
The reaction can also be promoted by ozone and hydrogen peroxide.
$SO_{2(g)} + O_{3(g)} \rightarrow SO_{3(g)} + O_{2(g)}$
$SO_{2(g)} + H_2O_{2(l)} \rightarrow H_2SO_{4(aq)}$