CBSE Class 11 Chemistry Sample Paper Set 1 Solution

Time allowed: 3 Hours **Max. Marks: 70**

Section-A (1 mark each)

Q1. Define common ion effect

Ans. The suppression in the degree of dissociation of weak electrolyte due to the addition of strong electrolyte having common ion with that of weak electrolyte is called common ion effect.

OR

Out of $FeCl_3$ and HNO_3 which will get hydrolyzed? What will be the nature of solution?

Ans. $FeCl_3$ undergoes hydrolysis. It is a salt of weak base, $Fe(OH)_2$ and strong acid, HCl. Upon hydrolysis it gives acidic solution.

$$2FeCl_3 + 4H_2O \longrightarrow 2Fe(OH)_2 + 6HCl$$

Q2. Define solubility product.

Ans. The product of concentration of ions in a saturated solution of sparingly soluble salt is called solubility product.

Q3. Define atomic mass unit.

Ans. Atomic mass unit is defined as the mass that is exactly equal to $1/12^{th}$ the mass of carbon-12 atom.

OR

State modern periodic law

Ans. Physical and chemical properties of the elements are periodic functions of their atomic number.

Q4. What are isotopes?

Ans. Atoms of same element having similar atomic number but different mass number are known as isotopes. E.g. $_1H^1$, $_1H^2$, $_1H^3$.

Q5. Define bond enthalpy.

Ans. The amount of energy required to break one mole of bonds of a particular type so as to separate them into gaseous atoms is known as bond enthalpy.

Section-B (2 marks each)

Q6. How many significant figures are present in 0.0025 and 2500?

Ans. 0.0025 has 2 significant figures. 2500 has 4 significant figures.

OR

Define aqueous tension.

Ans. Pressure developed due to water vapours in a gas sample collected over the water surface is known as aqueous tension.

Q7. What is the calorific value?

Ans. Calorific value is defined as the amount of heat obtained when 1 gm of food is burnt completely in the presence of oxygen.

OR

Calculate the pH of 10^{-8} M HCl solution.

Ans. $[H^+] = 10^{-8}$ M

Due to dissociation of H_2O, $[H^+] = 10^{-7}$ M

$\therefore$ Total $[H^+] = 10^{-8} + 10^{-7}$

$= 10^{-7}(0.1 + 1)$

$= 1.1 \times 10^{-7}$ moldm^{-3}

$\therefore pH = -\log_{10}[H^+]$

$= -[\log 1.1 \times 10^{-7}]$

$= -[\log 1.1 - 7 \log 10]$

$= -[0.11 - 7]$

$= 6.89$

Q8. Give two applications of Hess's Law.

Ans. (i) To determine enthalpy of formation.
(ii) To determine enthalpy of hydration.

Q9. Give two points of difference between s and p block elements.

Ans. (i) s block elements are metals whereas p block elements are non metals
(ii) s block elements have low ionisation energy whereas p block elements have high ionisation energy values.

Q10. Write four important properties of cathode rays.

Ans. Cathode rays have following properties:

(i) They consists of material particles
(ii) They travel in straight lines
(iii) They consists of negatively charged particles
(iv) They penetrate through thin aluminium foils and other metals as well.

Q11. Calculate the number of molecules present in 2.5 moles of water.

Ans. 1 mole of water = 6.023×10^{23}
Therefore, 2.5 moles of water = $(2.5 \times 6.022 \times 10^{23})/1$
$= 15.055 \times 10^{23}$ molecules

Q12. Give the geometry of XeO_3 and BrF_5

Ans. XeO_3 has trigonal pyramidal BrF_5has square pyramidal.

Section-C (3 marks each)

Q13.What is buffer capacity? Give the Henderson-Hasselbalch equation for acidic buffer.

Ans. The capacity of buffer solution to resist the changes in the pH value caused due to the addition of small amount of acid or base to it is called buffer capacity.

$$pH = pKa + \log \frac{[salt]}{[acid]}$$

Q14. pH of a solution is 6.8. Calculate H^+ and OH^-ion in the solution.
Ans. $pH = -\log_{10} [H^+]$
$6.8 = -\log [H^+]$
$\log [H^+] = -6.8$
$[H]^+ = \text{antilog } (\overset{-1}{-}\overset{+1}{6.8})$
$[H^+] = \text{antilog } (-7.2)$
$[H^+] = 1.585 \times 10^{-7} mol / dm^3$
$[H^+][OH^-] = K_w = 1 \times 10^{-14} mol dm^{-3}$

$$[OH^-] = \frac{1\times10^{-14}}{[H^+]} = \frac{1\times10^{-14}}{1.585\times10^{-7}} = 6.31\times10^{-8} \text{ mol dm}^{-3}$$

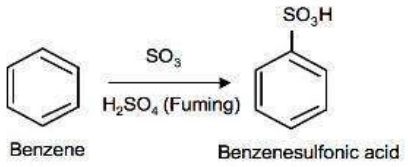
Q15. Explain Huckel's rule of aromaticity with suitable examples.

Ans. Huckel's rule determines the aromatic nature of the organic compound. According to this rule, those an organic compounds which are cyclic, planar and have 4n+2 π electrons (n = 1,2,3…..) possess aromaticity.

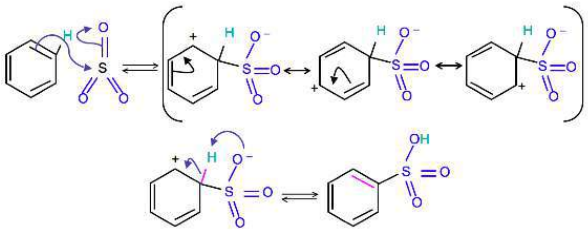
e.g. Benzene is cyclic, planar and follows 4n+2 π electrons, when n = 1, 4n+2 = 4×1+2 = 6 π electrons, so benzene is an aromatic compound.

Q16. Write the mechanism of sulphonation of benzene.

Ans. Sulphonation of benzene is an electrophilic substitution reaction.



Mechanism for the reaction is:



OR

Account for the following.

(a) Iodination of alkanes is carried out in the presence of oxidant. Why?

(b) Staggered conformation of ethane is most stable.
(c) Melting point of trans-2-butene is greater than cis 2-butene.

Solution

(a) Iodination is reversible and slow process. Oxidant such as HIO_3 decomposes HI back to I_2.
(b) Because of least torsional strain.
(c) Due to higher symmetry it is tightly packed in the crystal increasing the melting point.

Q17. Give the composition of each of the following: Limestone, slaked lime and washing soda.

Ans.
(a) Limestone – $CaCO_3$
(b) Slaked lime – $Ca(OH)_2$
(c) Quick lime - CaO

Q18. Give three postulates of VSEPR theory.

Ans. (i) In polyatomic molecules, the central atom is surrounded by shared pair of electron (bonding pair) and unshared pair of electron (lone pair).
(ii) Order of repulsion between different types of electron pairs is
Lone pair-lone pair > lone pair-bond pair > bond pair-bond pair
(iii) The shape of the molecule will depend on the number and types of pairs of electrons.

Q19. In a process, 764 J of heat is absorbed by a system and 269 J of work is done by the system. What is the change in internal energy for the process?
Ans. $\Delta E = q + w$
ΔE is change of internal energy
$Q = 764$ J
Work is done by the system so w is –ve
Formula used: $\Delta E = q + w = 764 - 269 = 495$ J

OR

Define state function. Give examples.

Ans. State function is a thermodynamic property which does not depend upon the path followed.

Examples are internal energy change (ΔE), enthalpy change (ΔH), entropy change (ΔS) and free energy (ΔG).

Q20. Give limitations of octet rule.

Ans. (i) Incomplete octet of central metal atom: Central metal atom in a molecule has less than eight electrons surrounding it. For example: BeH_2, BCl_3.
(ii) Odd electron molecules: Molecules with an odd number of electrons. For example: NO (Nitric oxide)
(iii) Expanded octet of central metal atom: In this central metal atom has more than eight electrons surrounding it in a molecule. For example: PCl_5 and SF_6.

OR

(a) Mention 2 anomalous properties of carbon.
(b) Complete the following reactions
(i) $BF_3 + LiAlH_4 \rightarrow$
(ii) $Al + NaOH + H_2O \rightarrow$
(iii) $B_2H_6 + CO \rightarrow$

Solution

(a) Anomalous properties of Carbon:
(i) No d-orbitals available.
(ii) It forms multiple bonds with itself and other atoms as well.

(b) (i) $4BF_3 + 3LiAlH_4 \rightarrow \underset{\text{diborane}}{2B_2H_6} + 3LiF + 3AlF_3$

(ii) $2Al + 2NaOH + 6H_2O \rightarrow \underset{\text{sodium tetrahydroxy aluminate}}{2Na[Al(OH)_4]} + 3H_2 \uparrow$

(iii) $B_2H_6 + 2CO \rightarrow 2BH_3.CO$

Q21.(a) Write a note on green chemistry.

(b) What is photochemical smog? Give example.
(c) Give an example for secondary pollutant.
Ans. (a) Green chemistry: It is the branch of chemistry which focuses on the designing of products and processes which decreases the usage and release of harmful chemicals and substances in the atmosphere.
(b) Photochemical smog has brown, hazy fumes that results in harmful effects on eyes, lungs of living beings and even leads to damage of plant life. Example is PAN (Peroxyacyl nitrate)
(c) Examples of secondary pollutant PAN (Peroxyacyl nitrate) formed by chemical reaction of primary pollutants. PAN is formed by the chemical reaction between hydrocarbons and oxides of nitrogen in the presence of sunlight.

Q22. (a) Define pH. A 0.02 M solution of pyridinium hydrochloride has pH = 3.44.

(b) Calculate the ionization constant of pyridine.

Ans. (a) pH is defined as negative logarithm of concentration of H^+ ions.

(b) $pH = -1/2 [\log K_W - \log K_b + \log c]$

$3.44 = -1/2 [-14 - \log K_b + \log 2.0 \times 10^{-2}]$

$6.88 = 14 + \log K_b + 1.70$

$\text{Log } K_b = -8.82 = 9.18$

$K_b = \text{antilog } 9.18 = 1.5 \times 10^{-9}$

OR

Give oxidation numbers of (i) S in H_2SO_5 (ii) Cr in CrO_5 (iii) N in NO_3^-

Ans. oxidation numbers of

(i) S in H_2SO_5 = +6

(ii) Cr in CrO_5 = +6

(iii) N in NO_3^- = +5

Q23. Give three uses of borax.

Ans. (i) making enamels and glazes.

(ii) Softening hard water

(iii)Qualitative analysis for borax bead test in labs.

Q24. Give three differences between Classical Smog and Photochemical Smog.

Ans.

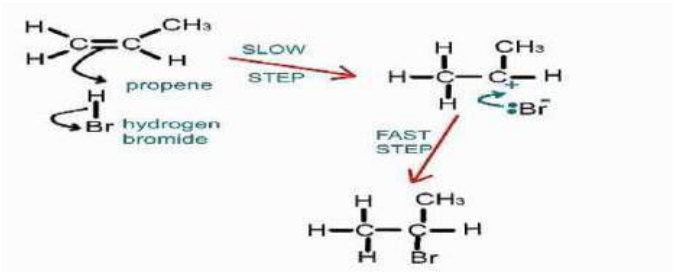
Classical Smog	Photochemical Smog
It is formed during winter months in the morning time.	It is formed during summer months in the afternoon time.
Causes problem in the lungs.	Causes irritation in the eyes.
It has reducing character.	It has oxidising character.

Section-D (5 marks each)

Q25. State Markownikoff's rule. Give the mechanism of addition of HBr to propene.

Ans. Markownikoff's rule: According to this rule, the positive part of the reactant will go to the C-atom having more number of hydrogen atoms and the negative part will go to the C-atom having less number of hydrogen atoms.

Mechanism of addition of HBr to propene:



OR

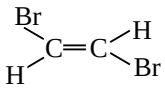
(a) Define geometrical isomers. Write geometrical isomers of CHBr = CHBr.

(b) Classify the following substituents as ortho, meta and para directing groups.

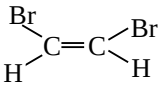
$-NO_2$, $-OCH_3$, $-OCOCH_3$, $-C\equiv N$

Solution

(a) Isomers resulted due to restricted rotation are called geometrical isomers.



trans-1,2-dibromoethene



cis-1,2-dibromo ethene

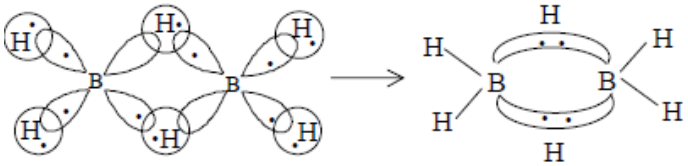
(b) $-NO_2$, $-C\equiv N$: –meta directing

$-OCH_3$, $-OCOCH_3$: ortho directing

Q26. (a) Describe the structure of diborane.

(b) Convert following in basic units: 35.6 pm and 34567 mg

Ans. (a) structure of diborane: it has 4 hydrogen atoms which are terminal, 2 hydrogen atoms which are present at bridging position between 2 boron atoms. Bridging hydrogen atoms are in the plane of the molecule. In diborane structure B-H-B bond is known as 3 centre -2 electron bond, shape looks like banana so known as banana bond.



Structure of diborane

(b) 35.6 pm = 3.56×10^{-11} m and 34567 mg = 3.4567×10^{-2} Kg

OR

Account for the following: 1 + 1 + 1 + 1 + 1 M

(a) conc. HNO_3 can be stored in aluminium containers. Give reason.
(b) orthoboric acid is monobasic acid.
(c) CO_2 is gas, SiO_2 is solid
(d) Graphite is used as lubricant.
(e) Borazine is more reactive than benzene.

Ans.

(a) Al becomes passive with conc. HNO_3 due to the development of oxide protective coating on the surface.

(b) It yields one H^+ in aqueous solution.

$B(OH)_3 + H_2O \rightarrow [B(OH)_4]^- + H^+$

(c) Carbon has smaller size and higher electronegativity than Si and forms pπ-pπ

bonding with 'O' to form CO_2 molecule.

Silicon atom has larger size and lower electronegativity and has small tendency to form pπ and pπ bonding.

(d) Graphite has layered structure and adjacent layers are held by weak van der Waals' force of attraction.

(e) Borazine has polar N $\rightarrow$B bonds.

Q27. Give FIVE Differences between Ionic and Covalent bond.

Ans. Differences between Ionic and Covalent bond

Ionic bond	Covalent bond
1. Formed by complete transfer of electrons from one atom to another	Formed by sharing of electrons between two atoms
2. Electrostatic forces of attraction present	Van der waals forces of attraction present
3. High melting points and boiling points	Low melting and boiling points
4. Polar and hence soluble in water	Non-polar and hence insoluble in water
5. Ionic compounds are non directional	Covalent compounds are directional

OR

What are allotropes? Discuss structure of crystalline forms of carbon.

Ans. An allotrope is defined as different forms of an element having different physical properties but same chemical properties.

1. Crystalline Solids: ordered arrangement of the constituents.

a) Diamond: It is the purest form of carbon and the hardest known substance

- Structure:

  - Each carbon is sp^3 hybridised and forms four covalent bonds with other carbon atoms. Thus giving a regular tetrahedron shape.
  - Each carbon lie at the corners of the tetrahedron.
  - Diamond is a three dimensional solid
  - C-C bond length is 154 pm or 1.54 A^O

b) Graphite: it found in metamorphic and igneous rocks and can also be prepared from coke. It is also the purest form of carbon.

- Structure:
  - Each carbon is sp^2 hybridised and is covalently bonded to three other carbon atoms, resulting in the formation of hexagonal rings.
  - Graphite has a two-dimensional structure which is in the form of a sheet or layered structure.
  - These layers are bonded together by van der waals forces which are weak forces of attraction, hence allowing one layer to slip over the other (which is the reason behind making graphite soft and useful lubricating agent)

- C-C bond length is 1.42 A^O and the separation between two layers is 3.35 A^O

c) Fullerenes: These are allotropes of carbon having spheroidal carbon cage molecules. These consist of C_{60}, C_{70} types. They look like football so known as Buckminster fullerene or bucky ball.

- Structure:
  - C_{60} is most stable, out of all the fullerenes.
  - It look like a football and hence named as bucky ball.
  - "Six carbon containing rings" (hexagons) are 20 in number and "five carbon containing rings" (pentagons) are 12.
  - Six carbon containing rings (hexagons) are bonded to both types of rings but five carbon containing rings (pentagons) are bonded only to six carbon containing rings.
  - C_{60} is spherical in shape with 60 vertices, each vertex has a sp^2 hybridised carbon.
  - It has 90 covalent bonds, constituting 60 single bonds and 30 double bonds . C-C single bond length is 145.3 pm and C=C double bond length is 138.3 pm.
  - C_{70}looks like a rugby ball and constitutes 12- five carbon containing rings (pentagons) and 25 rings which are six carbon containing rings (hexagons).