Covalent bonding

21. (a) Two identical atoms are joined with covalent bond so H_2 will be covalent.

22. (a) Covalent in CCl_4 and electrovalent in CaH_2

Explanation:

- In **carbon tetrachloride (CCl_4)**, carbon and chlorine share electrons, forming **covalent bonds**.
- In **calcium hydride (CaH_2)**, calcium (a metal) donates two electrons to two hydrogen atoms (nonmetals), forming **Ca^{2+} and H^- ions**, which are held together by **electrovalent (ionic) bonds**.

Hence, the bonding is **covalent in CCl_4** and **electrovalent in CaH_2**.

23. (c) Element 'X' has atomic no. 7 so its electronic configuration will be 2, 5. So its electron dot symbol would be $:\dot{\underset{\cdot}{X}}$.

24. (c) *C-S* will be most covalent. Covalent character depend on the size of cation and anion.

25. (c) *HCl* has ionic character yet it has covalent compound because electronegativity of chlorine is greater than that of hydrogen.

26. (c) *Order of polarising power* $Be^{++} > Li^{+} > Na^{+}$

Hence order of covalent character $BeCl_2 > LiCl > NaCl$.

27. (a) Greater than bond energy of H–bond

Explanation:

The **O–H covalent bond** in water is much stronger (bond energy ≈ 460 kJ/mol) than a **hydrogen bond** (bond energy ≈ 10–40 kJ/mol).

Hence, the **bond energy of the O–H covalent bond is greater** than that of a hydrogen bond.

28. (a) Molecular solid

Explanation:

Solid **methane (CH_4)** consists of **neutral CH_4 molecules** held together by weak **van der Waals forces (London dispersion forces)**.

Such solids are called **molecular solids**.

29. (a) Have similar electronegativities

Explanation:

A **covalent bond** forms when two atoms **share electrons**.

This sharing is possible only when both atoms have **similar or nearly equal electronegativities**, preventing electron transfer.

30. (d) Equally shared between them

Explanation:

When two **identical non-metal atoms** (e.g., H_2, Cl_2, O_2) bond together, their **electronegativity is the same**, so the **shared electron pair** is **equally attracted** to both atoms.

Thus, the electrons are **equally shared**, forming a **pure covalent bond**.

31. (b) Valency of phosphorus in H_3PO_4 is supposed 'x' then $3 + x - 8 = 0$, $x - 5 = 0$, $x = 5$.

32. (a) Germanium

Explanation:

- **Germanium (Ge)** is a **metalloid** that forms a **giant covalent (network) structure**, similar to silicon.
- **Sodium chloride (NaCl)** has **ionic bonding**.
- **Solid neon (Ne)** is held by **weak van der Waals forces** (no bonding between atoms).
- **Copper (Cu)** exhibits **metallic bonding**.

Hence, **Germanium** shows **covalent bonding**.

33. (d) $(+1)+x+3(-2)=0 \Rightarrow 1+x-6=0 \Rightarrow x=6-1=5$.

34. (a) HCl molecule has covalent bond.

35. (d) Electrovalent compounds have high melting point and high boiling point.

36. (b) Middle length of $H_2 = 74\ pm$

Length of $H = \frac{74}{2} = 37\ pm$

Middle length of $Cl_2 = 198\ pm$

Length of $Cl = \frac{198}{2} = 99\ pm$

Bond length of HCl = Length of H + Length of Cl

$= 37 + 99 = 136\ pm$

37. (d) Compound has 254 gm of I_2 means $\frac{254}{127} = 2$ mole, while 80 gm O_2 means $\frac{80}{16} = 5$ mole so they will form compound I_2O_5.

38. (c) NH_4Cl has covalent as well as ionic bond.

$$\left[\begin{array}{c} H \\ | \\ H-N \rightarrow H^{+} \\ | \\ H \end{array}\right] Cl^{-}$$

39. (d) Covalent character increases when we come down a group so CaI_2 will have highest covalent character.

40. (c) Low boiling point

Explanation:

Covalent compounds consist of **neutral molecules** held together by **weak intermolecular forces** (like van der Waals or dipole–dipole interactions).

As a result:

- They generally have **low melting and boiling points**.
- They are **poor conductors of electricity**.
- They are usually **insoluble in water** but soluble in organic solvents.

Hence, covalent compounds **commonly exhibit low boiling points**.