Electrovalent bonding

21. (b) Since the chloride of a metal is MCl_2 therefore metal '*M*' must be divalent *i.e*. M^{2+}. As a result the formula of its phosphate is $M_3(PO_4)_2$.

22. (d) In MPO_4 the oxidation state of *M* is +3. Hence, the formula of nitrate is $M(NO_3)_3$.

23. (a) Ion is formed by gaining or losing electrons. To form cation electron are lost from the valency shell, so *Zn* atoms to Zn^{++} ions there is a decrease in the no. of valency electron.

24. (a) $M_3(PO_4)_2$ means *M* is divalent so formula of its sulphate is MSO_4.

25. (b) As the molecular formula of chloride of a metal *M* is MCl_3, it is trivalent so formula of its carbonate will be $M_2(CO_3)_3$.

26. (d) Sodium chloride is electrovalent compound so it dissolves in water which is a polar solvent.

27. (d) When sodium chloride is dissolved in water, the sodium ion is hydrated.

28. (c) In solid there is no motion of ions

Explanation:
In the solid state, the ions in an ionic (electrovalent) compound are held firmly in fixed positions by strong electrostatic forces and cannot move freely. Since the conduction of electricity requires free movement of ions, solids do not conduct electricity. However, when melted or dissolved in water, the ions become free to move, and the substance conducts electricity.

29. (b) High charge on ions, small cation, large anion

Explanation:
Electrovalency (ionic bond formation) is favored when:

- The **cation** has a **small size and high positive charge** (high ionization potential).
- The **anion** has a **large size and high electron affinity** (easily gains electrons).

These factors promote the easy transfer of electrons and strong electrostatic attraction between ions, resulting in a stable ionic compound.

30. (d) Yet the formula of sulphate of a metal (M) is $M_2(SO_4)_3$, it is M^{3+} ion so formula of its phosphate would be MPO_4.

31. (b) Low ionisation potential and high electron affinity

Explanation:
Ionic (electrovalent) bonds are formed when one atom easily loses electrons and another easily gains them. The metal atom has a low ionisation potential, so it can lose electrons easily to form a cation. The non-metal atom has a high electron affinity, so it can gain electrons easily to form an anion. The oppositely charged ions are held together by strong electrostatic forces of attraction, forming an ionic bond.

Example: Na + Cl → Na^+ + Cl^- → NaCl

32. (b) Molten sodium chloride conducts electricity due to the presence of free ions.

33. (b) The phosphate of a metal has the formula $MHPO_4$ it means metal is divalent so its chloride would be MCl_2.

34. (d) These molecules have exceptionally high attractive forces in the lattice

Explanation:
Some ionic compounds like **$BaSO_4$, $CaCO_3$, and $PbSO_4$** are insoluble in water because the **electrostatic forces (lattice energy)** holding the ions together in their crystal lattice are **very strong**. The **hydration energy** released when these compounds try to dissolve in water is **not sufficient** to overcome the strong lattice energy. Hence, the ions cannot separate, and the compound remains insoluble in water.

35. (b) *Cs* is highly electropositive while *F* is highly electronegative so they will form ionic bond.

36. (a) KCl

Explanation:
Potassium chloride (KCl) is an **ionic compound** formed by the **transfer of one electron** from potassium (K) to chlorine (Cl). Potassium becomes a **cation (K^+)** and chlorine becomes an **anion (Cl^-)**. These oppositely charged ions are held together by **strong electrostatic forces of attraction**, forming an **ionic bond**.

Other options:

- CH_4 (methane) → covalent compound
- Diamond → covalent network solid
- H_2 → covalent molecule

37. (b) *Na* is highly electropositive while *Cl* is highly electronegative so they will form ionic bond.

38. (a) Ionic compounds are good conductors of heat and electricity so they are good electrolyte.

39. (a) Metal tends to lose electrons due to low ionization energy.

40. (c) As the formula of calcium pyrophosphate is $Ca_2P_2O_7$ means valency of pyrophosphate radical is – 4 so formula of ferric pyrophosphate is $Fe_4(P_2O_7)_3$.