1. Given the balanced equation representing a reaction:

$$Cl_2(g) \rightarrow Cl(g) + Cl(g)$$

What occurs during this change?

1) Energy is absorbed and a bond is broken.
2) Energy is absorbed and a bond is formed.
3) Energy is released and a bond is broken.
4) Energy is released and a bond is formed.

2. Which symbol represents a particle that has the same total number of electrons as S^{2-}?

1) O^{2-}
2) Si
3) Se^{2-}
4) Ar

3. Based on electronegativity values, which type of elements tends to have the greatest attraction for electrons in a bond?

1) metals
2) metalloids
3) nonmetals
4) noble gases

4. Which formula represents an ionic compound?

1) H_2
2) CH_4
3) CH_3OH
4) NHCl

5. Which substance contains bonds that involved the transfer of electrons from one atom to another?

1) CO_2
2) NH_3
3) KBr
4) Cl_2

6. Based on bond type, which compound has the highest melting point?

1) CH_3OH
2) C_6H_{14}
3) $CaCl_2$
4) CCl_4

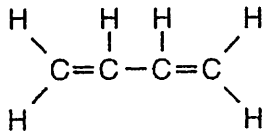
7. Which substance is an electrolyte?

1) CH_3OH
2) $C_6H_{12}O_6$
3) H_2O
4) KOH

8. In which material are the particles arranged in a regular geometric pattern?

1) $CO_2(g)$
2) NaCl(aq)
3) $H_2O(\ell)$
4) $C_{12}H_{22}O_{11}(s)$

9. Given the formula of a substance:



What is the total number of shared electrons in a molecule of this substance?

1) 22
2) 11
3) 9
4) 6

10. Which two substances are covalent compounds?

1) $C_6H_{12}O_6$ (s) and KI(s)
2) $C_6H_{12}O_6$ (s) and HCl(g)
3) KI(s) and NaCl(s)
4) NaCl(s) and HCl(g)

11. Which statement correctly describes diamond and graphite, which are different forms of solid carbon?

1) They differ in their molecular structure,only.
2) They differ in their properties, only.
3) They differ in their molecular structure and properties.
4) They do not differ in their molecular structure or properties.

12. Which characteristic is a property of molecular substances?

1) good heat conductivity
2) good electrical conductivity
3) low melting point
4) high melting point

13. Conductivity in a metal results from the metal atoms having

1) high electronegativity
2) high ionization energy
3) highly mobile protons in the nucleus
4) highly mobile electrons in the valence shell

14. Which substance contains metallic bonds?
    1) $Hg(\ell)$
    2) $H_2O(\ell)$
    3) NaCl(s)
    4) $C_6H_{12}O_6(s)$

15. Which compound has hydrogen bonding between its molecules?
    1) CH_4
    2) CaH_2
    3) KH
    4) NH_3

16. The degree of polarity of a chemical bond in a molecule of a compound can be predicted by determining the difference in the
    1) melting points of the elements in the compound
    2) densities of the elements in the compound
    3) electronegativities of the bonded atoms in a molecule of the compound
    4) atomic masses of the bonded atoms in a molecule of the compound

17. Which formula represents a nonpolar molecule containing polar covalent bonds?
    1) H_2O
    2) CCl_4
    3) NH_3
    4) H_2

18. At STP, fluorine is a gas and bromine is a liquid because, compared to fluorine, bromine has
    1) stronger covalent bonds
    2) stronger intermolecular forces
    3) weaker covalent bonds
    4) weaker intermolecular forces

19. Which formula represents a nonpolar molecule?
    1) H_2S
    2) HCl
    3) CH_4
    4) NH_3

20. What is the name of the polyatomic ion in the compound Na_2O_2?
    1) hydroxide
    2) oxalate
    3) oxide
    4) peroxide

21. At STP, fluorine is a gas and iodine is a solid. This observation can be explained by the fact that fluorine has
    1) weaker intermolecular forces of attraction than iodine
    2) stronger intermolecular forces of attraction than iodine
    3) lower average kinetic energy than iodine
    4) higher average kinetic energy than iodine

22. Which formula represents lead(II) chromate?
    1) $PbCrO_4$
    2) $Pb(CrO_4)_2$
    3) Pb_2CrO_4
    4) $Pb_2(CrO_4)_3$

23. A compound is made up of iron and oxygen, only. The ratio of iron ions to oxide ions is 2:3 in this compound. The IUPAC name for this compound is
    1) triiron dioxide
    2) iron(II) oxide
    3) iron(III) oxide
    4) iron trioxide

24. Which formula represents a binary compound?
    1) Ne
    2) Br_2
    3) C_3H_8
    4) H_2SO_4

25. Which is the formula for magnesium sulfide?
    1) MgS
    2) $MgSO_3$
    3) MnS
    4) $MnSO_3$

26. Which formula represents the compound aluminum iodide?
    1) AlI
    2) AlI_3
    3) Al_3I
    4) Al_3I_3

27. A metal, *M*, forms an oxide compound with the general formula M_2O. In which group on the Periodic Table could metal *M* be found?
    1) Group 1
    2) Group 2
    3) Group 16
    4) Group 17

28. What is the chemical formula for sodium sulfate?
    1) Na_2SO_3
    2) Na_2SO_4
    3) $NaSO_3$
    4) $NaSO_4$

29. An unknown element *X* can form a compound with the formula XBr_3. In which group on the Periodic Table would element *X* be found?

1) 1 3) 13
2) 2 4) 14

30. What is the chemical formula for copper(II) hydroxide?

1) CuOH 3) $Cu_2(OH)$
2) $CuOH_2$ 4) $Cu(OH)_2$

31. Explain, in terms of electronegativity, why a P-Cl bond in a molecule of PCl_5 is more polar than a P-S bond in a molecule of P_2S_5.

Base your answers to questions **32** and **33** on the balanced equation below.

$2Na(s) + Cl_2 \rightarrow 2NaCl(s)$

32. Explain, in terms of electrons, why the bonding in NaCl is ionic.

33. Draw a Lewis electron-dot diagram for a molecule of chlorine, Cl_2.

Base your answers to questions **34** through **36** on the information below.

Each molecule listed below is formed by sharing electrons between atoms when the atoms within the molecule are bonded together.

Molecule *A*: Cl_2
Molecule *B*: CCl_4
Molecule *C*: NH_3

34. Explain why NH_3 has stronger intermolecular forces of attraction than Cl_2.

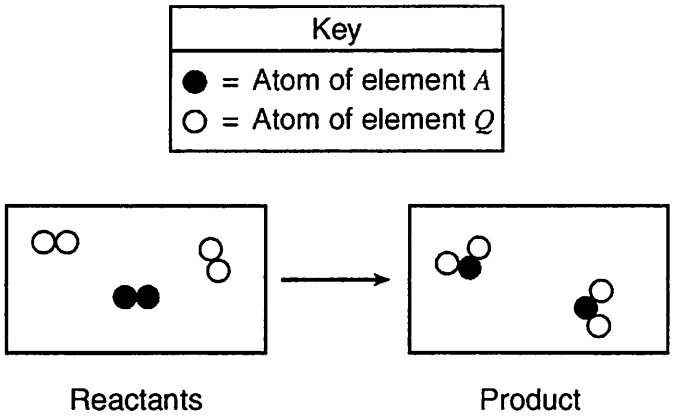
35. Draw the electron-dot (Lewis) structure for the NH_3 molecule.

36. Explain how the bonding in KCl is different from the bonding in molecules *A*, *B*, and *C*.

37. Explain, in terms of molecular structure or distribution of charge, why a molecule of methane is nonpolar.

Base your answers to questions **38** through **40** on the information below.

The particle diagrams below represent the reaction between two nonmetals, A_2 and Q_2.



38. Compare the total mass of the reactants to the total mass of the product.

39. Using the symbols A and Q, write the chemical formula of the product.

40. Identify the type of chemical bond between an atom of element A and an atom of element Q.