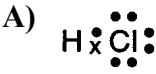
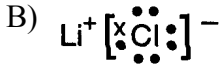

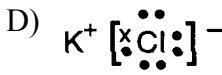
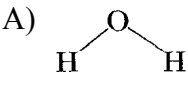
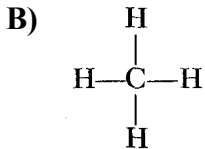
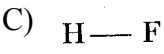
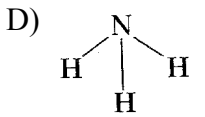


- As a chemical bond forms between two hydrogen atoms in a system, energy is released and the stability of the system
  - decreases
  - increases**
  - remains the same
- As two atoms of hydrogen combine to form a molecule of hydrogen, the total energy of the two atoms
  - decreases
  - increases
  - remains the same**
- What is conserved during a chemical reaction?
  - mass, only
  - charge, only
  - both mass and charge**
  - neither mass nor charge
- As a chemical bond forms between two hydrogen atoms, the potential energy of the atoms
  - decreases**
  - increases
  - remains the same
- As energy is released during the formation of a bond, the stability of the chemical system generally will
  - decrease
  - increase**
  - remain the same
- When a sodium atom reacts with a chlorine atom to form a compound, the electron configurations of the ions forming the compound are the same as those in which noble gas atoms?
  - krypton and neon
  - krypton and argon
  - neon and helium
  - neon and argon**
- Which electron-dot diagram represents  $H_2$ ?
  - $H \cdot H$
  - $H \text{ : } H$
  - $\begin{array}{c} \cdot \cdot \\ \cdot \cdot \\ \cdot H \cdot H \cdot \\ \cdot \cdot \\ \cdot \cdot \end{array}$
  - $\begin{array}{c} \cdot \cdot \\ \cdot \cdot \\ \cdot H \cdot H \cdot \\ \cdot \cdot \\ \cdot \cdot \end{array}$
- Which is the correct electron-dot formula for a molecule of chlorine?
  - $\begin{array}{c} \cdot \cdot \\ \cdot Cl : Cl \cdot \\ \cdot \cdot \end{array}$
  - $\begin{array}{c} \cdot \cdot \\ : Cl : : Cl : \\ \cdot \cdot \end{array}$
  - $\begin{array}{c} \cdot \cdot \\ : Cl : : Cl : \\ \cdot \cdot \end{array}$
  - $\begin{array}{c} \cdot \cdot \\ : Cl : Cl : \\ \cdot \cdot \end{array}$
- A barium atom attains a stable electron configuration when it bonds with
  - one chlorine atom
  - two chlorine atoms**
  - one sodium atom
  - two sodium atoms
- Which pair of elements below will form a compound with the greatest ionic character?
  - Pb and F
  - Ca and O**
  - Na and Cl
  - Cs and N
- Which pair of elements forms a bond with the *least* ionic character?
  - P–Cl
  - Br–Cl**
  - H–Cl
  - O–Cl
- Based on your Reference Tables, the atoms of which of these elements have the strongest attraction for electrons in a chemical bond?
  - N**
  - Na
  - P
  - Pt
- As a chlorine atom becomes a negative ion, the atom
  - gains an electron and its radius increases**
  - gains an electron and its radius decreases
  - loses an electron and its radius increases
  - loses an electron and its radius decreases
- Which compound contains ionic bonds?
  - NO
  - NO<sub>2</sub>
  - CaO**
  - CO<sub>2</sub>
- The bonds in BaO are best described as
  - covalent, because valence electrons are shared
  - covalent, because valence electrons are transferred
  - ionic, because valence electrons are shared
  - ionic, because valence electrons are transferred**
- A substance that has a melting point of 1074 K conducts electricity when dissolved in water, but does *not* conduct electricity in the solid phase. The substance is most likely
  - an ionic solid**
  - a network solid
  - a metallic solid
  - a molecular solid
- Which substance is an electrolyte?
  - CH<sub>3</sub>OH
  - C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>
  - H<sub>2</sub>O
  - KOH**

## Regents review Chemical bonding

18. A solid substance was tested in the laboratory. The test results are listed below.
- dissolves in water
  - is an electrolyte
  - melts at a high temperature
- Based on these results, the solid substance could be
- A) Cu                                      **B) CuBr<sub>2</sub>**  
 C) C                                         D) C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>
19. A substance was found to be a soft, non-conducting solid at room temperature. The substance is most likely
- A) a molecular solid**    B) a network solid  
 C) a metallic solid        D) an ionic solid
20. Which two substances are covalent compounds?
- A) C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> (s) and KI(s)  
**B) C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> (s) and HCl(g)**  
 C) KI(s) and NaCl(s)  
 D) NaCl(s) and HCl(g)
21. Which is the correct electron-dot formula for a hydrogen molecule at STP?
- A) H·    B) H:    C) H·H    **D) H:H**
22. Which molecule will have a double covalent bond?
- A) F<sub>2</sub>    **B) O<sub>2</sub>**    C) Cl<sub>2</sub>    D) N<sub>2</sub>
23. Which type of bonding is found in all molecular substances?
- A) covalent bonding**    B) hydrogen bonding  
 C) ionic bonding         D) metallic bonding
24. Which formula represents a molecular compound?
- A) HI**    B) KI    C) KCl    D) LiCl
25. What is the maximum number of covalent bonds that a carbon atom can form?
- A) 1    B) 2    C) 3    **D) 4**
26. Which properties do naturally occurring metal compounds generally possess?
- A) high stability and low solubility in water**  
 B) high stability and high solubility in water  
 C) low stability and low solubility in water  
 D) low stability and high solubility in water
27. Which substance at STP conducts electricity because the substance contains mobile electrons?
- A) H    B) He    **C) K**    D) Kr
28. Which property best accounts for the conductivity of metals?
- A) the relatively high first ionization energy  
 B) the malleability of most metals  
**C) the free electrons in the valence energy levels**  
 D) the filled inner electron energy levels
29. The bonds in all network solids are
- A) covalent**                                B) ionic  
 C) metallic                                 D) nonpolar
30. Which substance contains nonpolar covalent bonds?
- A) H<sub>2</sub>**                                        B) H<sub>2</sub>O  
 C) Ca(OH)<sub>2</sub>                                D) CaO
31. The chemical bond in a hydrogen molecule is
- A) nonpolar covalent**    B) polar covalent  
 C) ionic                                      D) electrovalent
32. Which electron-dot diagram represents a molecule that has a polar covalent bond?
- A)                                 B) 
- C)                                 D) 
33. Which of the following compounds has the highest boiling point?
- A) H<sub>2</sub>O**    B) H<sub>2</sub>S    C) H<sub>2</sub>Se    D) H<sub>2</sub>Te
34. Which type of bond exists between an atom of carbon and an atom of fluorine?
- A) ionic                                      B) metallic  
**C) polar covalent**                        D) nonpolar covalent
35. Which structural formula represents a nonpolar symmetrical molecule?
- A)                                 B) 
- C)                                 D) 

36. Why is a molecule of  $\text{CO}_2$  nonpolar even though the bonds between the carbon atom and the oxygen atoms are polar?
- A) **The shape of the  $\text{CO}_2$  molecule is symmetrical.**  
B) The shape of the  $\text{CO}_2$  molecule is asymmetrical.  
C) The  $\text{CO}_2$  molecule has a deficiency of electrons.  
D) The  $\text{CO}_2$  molecule has an excess of electrons.
37. Molecules in a sample of  $\text{NH}_3(\ell)$  are held closely together by intermolecular forces
- A) existing between ions  
B) existing between electrons  
C) caused by different numbers of neutrons  
D) **caused by unequal charge distribution**
38. In aqueous solution, a chloride ion is attracted to which end of the water molecule?
- A) **the hydrogen end, which is the positive pole**  
B) the hydrogen end, which is the negative pole  
C) the oxygen end, which is the positive pole  
D) the oxygen end, which is the negative pole
39. Two fluorine atoms are held together by a covalent bond. Which statement correctly describes this bond?
- A) It is polar and forms a polar molecule.  
B) It is polar and forms a nonpolar molecule.  
C) It is nonpolar and forms a polar molecule.  
D) **It is nonpolar and forms a nonpolar molecule.**
40. Base your answers to the following questions on the information given below.

Testing of an unknown solid shows that it has the properties listed below.

- (1) low melting point  
(2) nearly insoluble in water  
(3) poor conductor of electricity  
(4) relatively soft solid

a State the type of bonding that would be expected in the particles of this substance.]

b Explain in terms of attractions between particles why the unknown solid has a low melting point.

c Explain why the particles of this substance are nonconductors of electricity.

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## Regents review Chemical bonding

Base your answers to questions 41 through 44 on the information below.

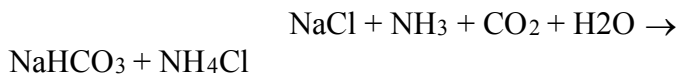
During a fireworks display, salts are heated to very high temperatures. Ions in the salts absorb energy and become excited. Spectacular colors are produced as energy is emitted from the ions in the form of light.

The color of the emitted light is characteristic of the metal ion in each salt. For example, the lithium ion in lithium carbonate,  $\text{Li}_2\text{CO}_3$ , produces a deep-red color. The strontium ion in strontium carbonate,  $\text{SrCO}_3$ , produces a bright-red color. Similarly, calcium chloride is used for orange light, sodium chloride for yellow light, and barium chloride for green light.

41. Explain, in terms of subatomic particles and energy states, how the colors in a fireworks display are produced.
42. Determine the oxidation state of carbon in the salt used to produce a bright-red color.
43. Identify the *two* types of chemical bonds found in the salt used to produce a deep-red color.
44. Write the formula for the salt used to produce green light in a fireworks display.

- 
45. Base your answer to the following question on the information below.

In 1864, the Solvay process was developed to make soda ash. One step in the process is represented by the balanced equation below.



In the space draw a Lewis electron-dot diagram for the reactant containing nitrogen in the equation.

46. Base your answer to the following question on the information below.

### Physical Properties of $\text{CF}_4$ and $\text{NH}_3$ at Standard Pressure

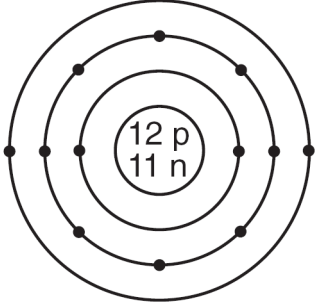
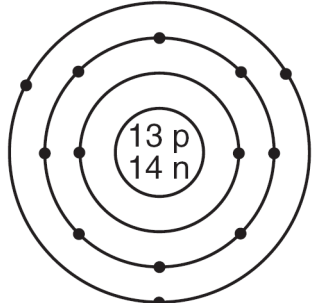
Compound	Melting Point ( $^{\circ}\text{C}$ )	Boiling Point ( $^{\circ}\text{C}$ )	Solubility in Water at $20.0^{\circ}\text{C}$
$\text{CF}_4$	-183.6	-127.8	insoluble
$\text{NH}_3$	-77.7	-33.3	soluble

In the space *in your answer booklet*, draw a Lewis electron-dot diagram for  $\text{CF}_4$ .

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47. Base your answer to the following question on the information below.

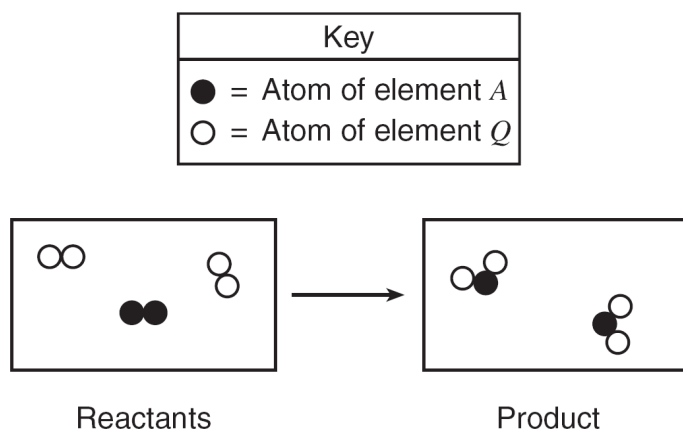
**Atomic Diagrams of Magnesium and Aluminum**

<p><b>Key</b></p> <p>• = electron</p>	<p><b>Element</b></p>	<p><b>Lewis Electron-Dot Diagram</b></p>	<p><b>Electron-Shell Diagram</b></p>
	<p>magnesium</p>	<p>Mg:</p>	
	<p>aluminum</p>	<p>Al:</p>	

Explain why Lewis electron-dot diagrams are generally more suitable than electron-shell diagrams for illustrating chemical bonding.

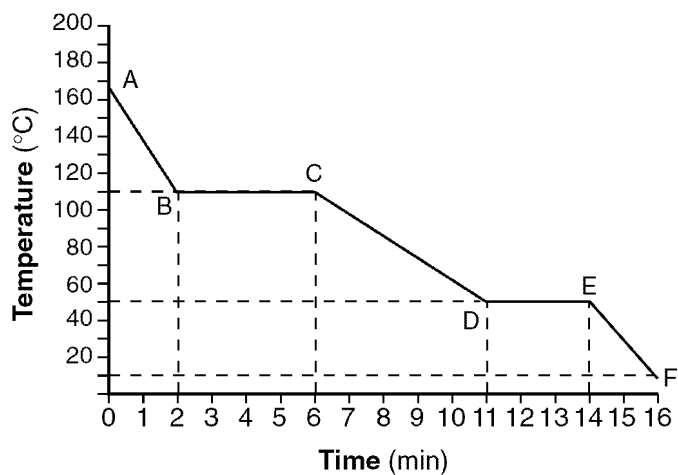
48. Base your answer to the following question on the information below.

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



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

49. Base your answer to the following question on the graph below, which represents the cooling of a substance starting at a temperature above its boiling point.



Which segment of the graph represents the gas phase, only?

50. Base your answer to the following question on the table below.

**Physical Properties of Four Gases**

Name of Gas	hydrogen	hydrogen chloride	hydrogen bromide	hydrogen iodide
Molecular Structure	H-H	H-Cl	H-Br	H-I
Boiling Point (K) at 1 Atm	20.	188	207	237
Density (g/L) at STP	0.0899	1.64	?	5.66

Explain, in terms of molecular polarity, why hydrogen chloride is more soluble than hydrogen in water under the same conditions of temperature and pressure.

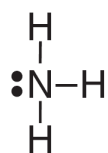
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**Answer Key**

**Regents review Chemical Bonding 2011-2012**

1. **B**
2. **C**
3. **C**
4. **A**
5. **B**
6. **D**
7. **B**
8. **D**
9. **B**
10. **B**
11. **B**
12. **A**
13. **A**
14. **C**
15. **D**
16. **A**
17. **D**
18. **B**
19. **A**
20. **B**
21. **D**
22. **B**
23. **A**
24. **A**
25. **D**
26. **A**
27. **C**
28. **C**
29. **A**
30. **A**
31. **A**
32. **A**
33. **A**
34. **C**
35. **B**
36. **A**

37. **D**
38. **A**
39. **D**
40. *a* covalent or molecular or nonpolar covalent  
*b* Examples: -The intermolecular attractions between the particles of the solid are weak. -Weak intermolecular attractions.  
*c* Example: -There are no freely moving charged particles
41.  $\Delta$ ; When electrons in the ions move from higher energy states to lower energy states, lights of specific wavelengths are emitted.  $\Delta$ ; Light is emitted when electrons return from higher electron shells to lower electron shells.
42. +4
43. ionic bonds and polar covalent bonds/covalent and ionic
44.  $\text{BaCl}_2$



46. 
47. Lewis electron-dot diagrams only show valence electrons, which are involved in bonding.
48. *Examples:* —The total mass of reactants equals the total mass of product. —Mass of reactants equals mass of product.—Mass is conserved.
49. *Examples:*—  $\overline{AB}$  — from time 0 to 2 minutes
50. *Examples:* — HCl's molecular polarity is more similar to water's polarity than H<sub>2</sub>'s polarity compared to water's — HCl and water both polar, H<sub>2</sub> nonpolar, like dissolves like — HCl polarity is more similar to water's polarity