

VIRGINIA STANDARDS OF LEARNING

Spring 2007 Released Test

# END OF COURSE CHEMISTRY

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Form S0117, CORE 1

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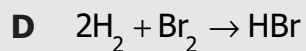
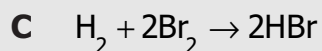
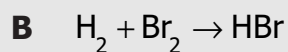
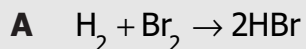


**Directions**

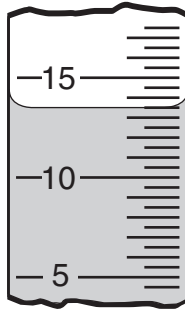
Read each question carefully and choose the best answer. Then mark the space on your answer document for the answer you have chosen.

**SAMPLE**

**Which of the following is a balanced equation?**



**1**



**What is the volume of the liquid in the graduated cylinder?**

- A** 13.00 mL
- B** 13.50 mL
- C** 14.00 mL
- D** 14.50 mL

**2 Atoms of the noble gases are generally inert because —**

- F** they are too large to react
- G** they are not charged
- H** they are neutral atoms
- J** their outer electron levels are filled

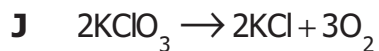
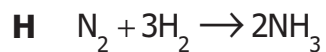
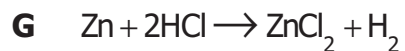
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Element	Mass in Grams for a Mole of Atoms
Ca	40
H	1
O	16

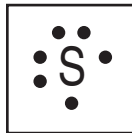
What is the mass of a mole of  $\text{Ca(OH)}_2$  ?

- A 57 grams
- B 58 grams
- C 74 grams
- D 114 grams

4 Which of these represents a synthesis reaction?



**5 Sulfur is represented by the following Lewis dot structure:**

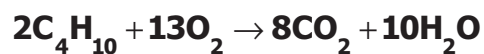


**Which of the elements has the same Lewis structure?**

- A** Chlorine
- B** Magnesium
- C** Oxygen
- D** Phosphorus

**6 A mixture of gases with a pressure of 800.0 mm Hg contains 60% nitrogen and 40% oxygen by volume. What is the partial pressure of oxygen in this mixture?**

- F** 140.0 mm Hg
- G** 320.0 mm Hg
- H** 373.0 mm Hg
- J** 480.0 mm Hg



The equation shows the combustion of butane ( $\text{C}_4\text{H}_{10}$ ). How many moles of water can be produced by 12.5 moles of  $\text{C}_4\text{H}_{10}$  with excess oxygen?

- A 2.50 mol
- B 62.5 mol
- C 125 mol
- D 202 mol

8 The formula for magnesium chloride is —

- F  $\text{MgCl}_2$
- G  $\text{MnCl}$
- H  $\text{Mg}_2\text{Cl}_3$
- J  $\text{MnCl}_2$

9 What are the numbers of protons, neutrons, and electrons in an isotope of titanium with a mass number of 50?

- A 22 p, 22 n, 28 e
- B 28 p, 22 n, 22 e
- C 50 p, 22 n, 50 e
- D 22 p, 28 n, 22 e

## Molar Heat of Vaporization

H <sub>2</sub> O	40.7 kJ/mole
NH <sub>3</sub>	23.4 kJ/mole

**Water and ammonia have different molar heats of vaporization. The *best* interpretation, at the molecular level, is that water molecules —**

- F** have stronger intermolecular attractions
- G** occupy larger molecular volumes
- H** set up stronger repulsive nuclear forces
- J** collide more frequently with each other

**11 Which of these statements describes what happens to the molecules of a solid as the temperature is lowered to absolute zero ( $-273^{\circ}\text{C}$ )?**

- A** They begin to take up more space.
- B** They become farther apart.
- C** Their kinetic energy gradually increases to a maximum.
- D** Their motion gradually decreases and eventually stops.



- 12** A sample of iron has a volume of 10.0 mL. The density of iron is 7.87 g/mL. Which is the correct expression to calculate the mass of the sample using dimensional analysis?

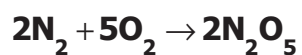
**F**  $10.0\text{mL} \times \frac{7.87\text{g}}{1\text{mL}}$

**G**  $10.0\text{mL} \times \frac{1\text{g}}{7.87\text{mL}}$

**H**  $10.0\text{mL} \times \frac{1\text{mL}}{7.87\text{g}}$

**J**  $10.0\text{mL} \times \frac{7.87\text{mL}}{1\text{g}}$

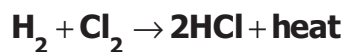
**13**



What mass of nitrogen is required to react with 16 grams of oxygen?

- A** 2.8 g
- B** 5.6 g
- C** 14 g
- D** 56 g

- 14 Hydrogen chloride can be formed from hydrogen and chlorine as shown in the reaction.



Chlorine and fluorine are located in the same group in the periodic table. If the reaction were performed with fluorine instead of chlorine, how many moles of  $\text{H}_2$  would be required to balance the equation?

- F 1
- G 2
- H 4
- J 8

- 15 The correct name for  $\text{Mg}_3(\text{PO}_4)_2$  is —

- A magnesium phosphite
- B trimagnesium phosphate
- C magnesium(III) phosphate
- D magnesium phosphate

- 16 How many protons are in an atom represented by  ${}^{220}_{88}\text{Ra}$ ?

- F 88
- G 132
- H 220
- J 308

Student Measurements of Temperature

	Reading 1 ( $^{\circ}\text{C}$ )	Reading 2 ( $^{\circ}\text{C}$ )	Reading 3 ( $^{\circ}\text{C}$ )
Student 1	78.6	78.5	78.7
Student 2	82.4	80.0	81.4
Student 3	80.0	78.9	81.8
Student 4	80.1	79.9	80.0

Four students each took three temperature readings of a sample of water. The actual temperature of the sample was  $80.0^{\circ}\text{C}$ . Which student's measurements were both accurate and precise?

- A Student 1
- B Student 2
- C Student 3
- D Student 4

18 According to the kinetic-molecular theory of gases, molecules of an ideal gas —

- F travel in curved lines of motion
- G undergo elastic collisions
- H are separated by small distances
- J have strong forces between them

**19 What is the molar mass of beryllium oxide (BeO)?**

- A** 12 g/mol
- B** 13 g/mol
- C** 24 g/mol
- D** 25 g/mol

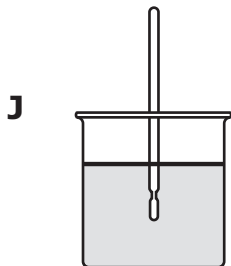
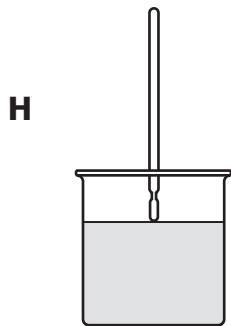
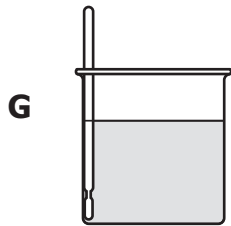
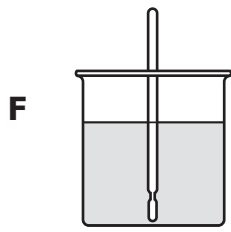
**20 Catalytic converters made of palladium (Pd) reduce automobile pollution by catalyzing the reaction between unburned hydrocarbons and oxygen. How does Pd increase the rate of this reaction?**

- F** By cooling the reactants
- G** By splitting the oxygen atoms
- H** By giving the hydrocarbons a negative charge
- J** By decreasing the activation energy

**21 A chloride ion ( $\text{Cl}^-$ ) has the same number of electrons as a neutral atom of —**

- A** fluorine
- B** sulfur
- C** argon
- D** bromine

22 Which of these is the proper method for using a thermometer to measure the temperature of liquid in a beaker?



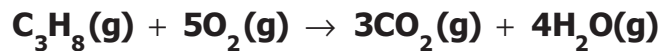
<b>O</b> 3.5	<b>F</b> 4.0
<b>S</b> 2.5	<b>Cl</b> ?
<b>Se</b> 2.4	<b>Br</b> 2.8

Which of the following is *most* likely the electronegativity value for chlorine?

- A** 2.3
- B** 2.7
- C** 3.0
- D** 4.2

**24** Which compound has a covalent bond?

- F**  $\text{CaI}_2$
- G**  $\text{KBr}$
- H**  $\text{NaCl}$
- J**  $\text{NO}$



If 5.0 moles of  $\text{C}_3\text{H}_8$  react, how many molecules of water are formed?

- A  $3.0 \times 10^{24}$
- B  $4.8 \times 10^{24}$
- C  $1.2 \times 10^{25}$
- D  $2.4 \times 10^{25}$

26 Which of these *best* describes sublimation?

- F A solid changing to a liquid phase
- G A solid changing to a gaseous phase
- H A gas filling the space in its container
- J A liquid taking the shape of its container

27 If the difference in electronegativity between atoms of different non-metals is small, the atoms of the two non-metals will *most* likely —

- A form an ionic bond
- B form a hydrogen bond
- C form a covalent bond
- D form a metallic bond

**28 The role of a catalyst is to affect —**

- F** electronegativity
- G** heat content
- H** activation energy
- J** ionization energy

**29 Which of these *best* describes the difference between the formulas for nitrogen monoxide and nitrogen dioxide?**

- A** Nitrogen monoxide has one more atom of nitrogen.
- B** Nitrogen dioxide has one fewer atom of oxygen.
- C** Nitrogen monoxide has one fewer atom of oxygen.
- D** Nitrogen dioxide has one more atom of nitrogen.

**30 Sulfuric acid ( $\text{H}_2\text{SO}_4$ ) is spilled on a laboratory bench. Which chemical would be useful for neutralizing the acid?**

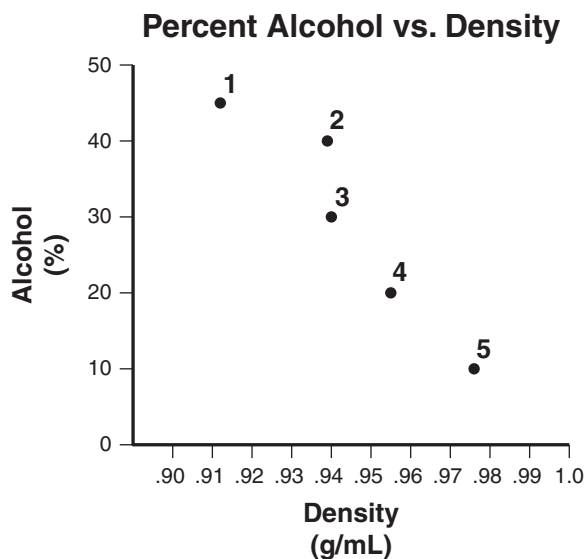
- F** Aluminum chloride ( $\text{AlCl}_3$ )
- G** Potassium nitrate ( $\text{KNO}_3$ )
- H** Silver iodide ( $\text{AgI}$ )
- J** Sodium bicarbonate ( $\text{NaHCO}_3$ )



**31** When compared to sulfur-32, sulfur-34 has more —

- A** protons
- B** neutrons
- C** energy levels
- D** bonding configurations

**32**



The graph shows five data points collected in an investigation of the relationship between the concentration of alcohol dissolved in water and its density. The relationship was expected to be linear. Which of the data points *most* likely resulted from an error in procedure?

- F** 1
- G** 2
- H** 4
- J** 5

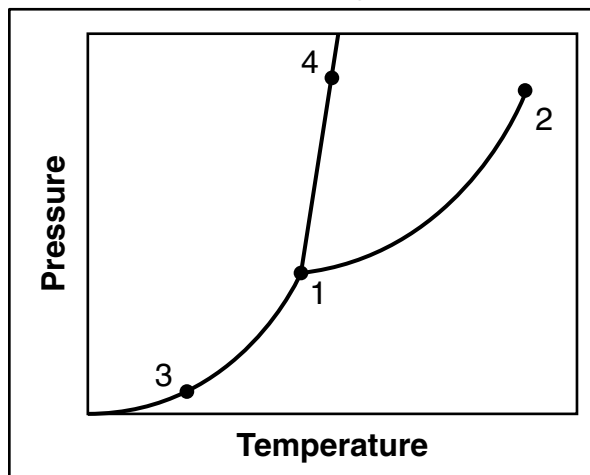
**33** What is the chemical name for the compound  $\text{P}_3\text{N}_5$ ?

- A** Triphosphorus nitride
- B** Phosphorus(III) nitride
- C** Triphosphorus pentanitride
- D** Pentaphosphorus trinitride

**34** In  $\text{HNO}_3$ , the oxidation state of hydrogen is +1 and the oxidation state of oxygen is -2. Therefore, the oxidation state of nitrogen is —

- F** -1
- G** +3
- H** +4
- J** +5

Phase Diagram



The graph shows the phase diagram of a substance. At which point on the diagram do the solid, liquid, and gas phases coexist simultaneously?

- A 1
- B 2
- C 3
- D 4

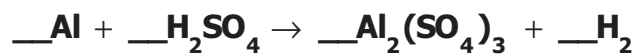
- 36** The partial pressures of the gases that comprise air are shown in the table.

**Partial Pressures  
of Gases in Air**

<b>Gas</b>	<b>Partial Pressure (mm Hg)</b>
Ar	7.10
CO <sub>2</sub>	?
N <sub>2</sub>	593.44
O <sub>2</sub>	159.20
Others	0.02

**If the total atmospheric pressure is 760.00 mm Hg, what is the partial pressure of CO<sub>2</sub>?**

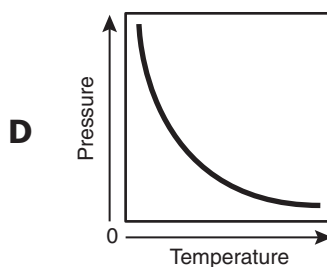
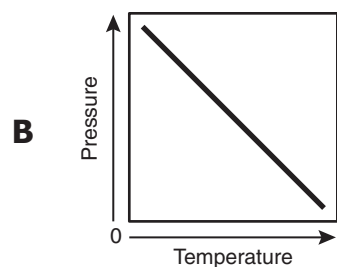
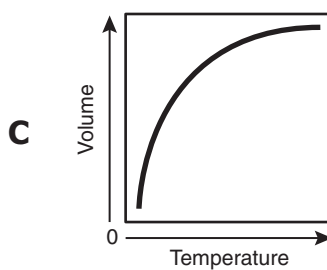
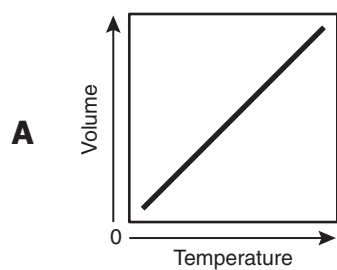
- F** 0.03 mm Hg  
**G** 0.24 mm Hg  
**H** 7.36 mm Hg  
**J** 759.76 mm Hg
- 37** Which is the safest practice when heating the contents of a test tube over a flame?
- A** Wearing long hair down  
**B** Having safety goggles within reach  
**C** Pointing the test tube away from people  
**D** Keeping the test tube securely stoppered



When the equation is correctly balanced, the coefficient of  $\text{H}_2\text{SO}_4$  is —

- F** 1
- G** 2
- H** 3
- J** 4

39 Which graph shows the relationship between temperature and volume as described in Charles' Law?



**40** Place the following models about the structure of the atom in the order that they were developed:

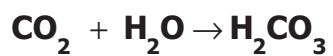
- 1. Planetary model**
- 2. Quantum mechanical model**
- 3. Solid sphere model**

- F** 1, 3, 2  
**G** 1, 2, 3  
**H** 2, 3, 1  
**J** 3, 1, 2

**41** The boiling point of ethanol is 78.3°C. The boiling point of ethanol on the Kelvin scale is approximately —

- A** 26 K  
**B** 178 K  
**C** 351 K  
**D** 451 K

**42**



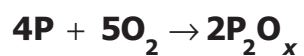
**The reaction is which type of chemical reaction?**

- F** Single replacement  
**G** Double replacement  
**H** Synthesis  
**J** Decomposition

**43 What does pH measure?**

- A** Hydrogen ion concentration
- B** Hydroxide ion concentration
- C** Acid density
- D** Base density

**44**



**The subscript of oxygen in the product should be —**

- F** 2
- G** 5
- H** 10
- J** 20

**45 The proper scientific notation for 565,000,000,000 is —**

- A**  $.565 \times 10^{12}$
- B**  $5.65 \times 10^{11}$
- C**  $56.5 \times 10^{10}$
- D**  $565 \times 10^9$

**46 What are shared in covalent bonds?**

- F** Cations
- G** Protons
- H** Electrons
- J** Anions

**47 A 0.67 L solution of ammonium sulfate,  $(\text{NH}_4)_2\text{SO}_4$ , contains 0.81 mole of the solute. What is the approximate molarity of the solution?**

- A** 0.54 M
- B** 0.83 M
- C** 1.2 M
- D** 1.5 M

**48 Which of these is the percent of error in evaluating the molecular mass of a compound if the experimental value was 105.2 amu and the known value was 107.5 amu?**

- F** 1.0%
- G** 2.1%
- H** 3.3%
- J** 4.2%



**49 What is the correct formula for aluminum chloride?**

- A**  $\text{AlCl}_3$
- B**  $\text{Al}_3\text{Cl}$
- C**  $\text{Al}_2\text{Cl}_3$
- D**  $\text{AlCl}$

**50**



**$\text{NO}_2$  and  $\text{N}_2\text{O}_4$  undergo the reaction shown. When a sealed container of  $\text{NO}_2$  reaches chemical equilibrium, which must be true?**

- F** No  $\text{N}_2\text{O}_4$  is present.
- G** No chemical reactions are occurring.
- H** The rates of the forward and reverse reactions are equal.
- J** The maximum number of molecules has been reached.