

VIRGINIA STANDARDS OF LEARNING

Spring 2009 Released Test

# END OF COURSE CHEMISTRY

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Form S0119, CORE 1

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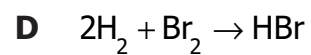
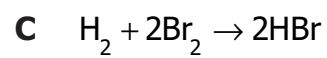
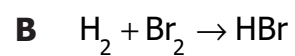
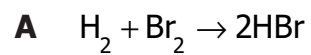


**Directions**

Read each question and choose the best answer.

**SAMPLE**

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



**1 Which of these would be *best* to measure 12.6 mL of liquid ethanol?**

- A** 25 mL beaker
- B** 25 mL volumetric flask
- C** 25 mL Erlenmeyer flask
- D** 25 mL graduated cylinder

**2 Potassium (K) has a smaller atomic mass than argon (Ar) even though the atomic number of potassium is larger than the atomic number of argon. Which of the following *best* accounts for this observation?**

- F** At STP, potassium is in the solid phase, but argon is a gas.
- G** It is easier for a potassium atom to lose an electron than it is for an argon atom.
- H** The most common isotopes of argon have more protons than the most common isotopes of potassium.
- J** The most common isotopes of potassium have fewer neutrons than the most common isotopes of argon.

3 Which of the following is the correct Lewis electron-dot diagram for the sodium atom?



4 A compound has a mass of  $2.6632 \times 10^2$  g/mol. The number of significant figures in this mass is —

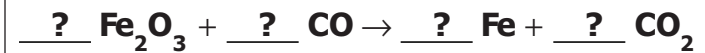
F 2

G 4

H 5

J 7

5



What are the coefficients of the correctly balanced equation?

- A 1, 3, 2, 3
- B 0, 2, 2, 3
- C 1, 2, 2, 2
- D 2, 6, 4, 3

6 The correct formula for dinitrogen pentoxide is —

- F  $\text{N}_2\text{O}_5$
- G  $\text{N}_5\text{O}$
- H  $\text{NO}_5$
- J  $\text{N}_2\text{O}$

7 When ionic compounds are named, the name of a monatomic anion will end in which of the following suffixes?

- A -ic
- B -ite
- C -ate
- D -ide

**8** When 1 g of sodium chloride (NaCl) is placed in 100 g of water, a solution results. Once the solution is prepared, water is now considered what part of the solution?

- F** Solid
- G** Liquid
- H** Solute
- J** Solvent

**9** What is the name of the compound with the formula  $\text{PCl}_5$ ?

- A** Phosphorus(I) chloride
- B** Phosphorus(V) chlorine
- C** Phosphorus pentachlorate
- D** Phosphorus pentachloride

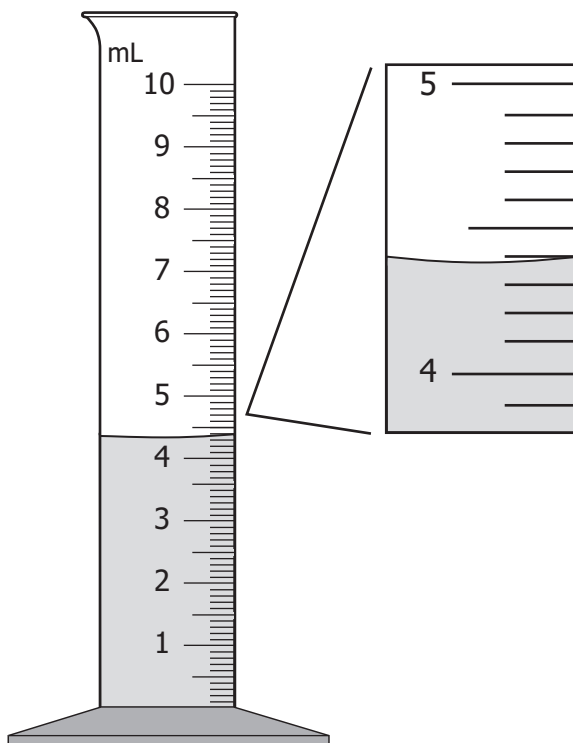
**10** How many electrons does the iron ion have when it forms the ionic compound  $\text{FeCl}_3$ ?

- F** 20
- G** 23
- H** 26
- J** 29

**11 Covalent bonds mainly occur between —**

- A** two nonmetallic elements
- B** two metallic elements
- C** one metallic element and one nonmetallic element
- D** one metalloid and one metallic element

**12**



**What is the volume of the water in this graduated cylinder?**

- F** 4.39 mL
- G** 4.41 mL
- H** 4.55 mL
- J** 5.61 mL



**13** If substance X is a liquid, substance Y is a gas, and substance Z is a solid, and all are at the same temperature and pressure, then the order of increasing strength of their intermolecular forces would be —

- A**  $X < Y < Z$
- B**  $Y < X < Z$
- C**  $Z < Y < X$
- D**  $Y < Z < X$

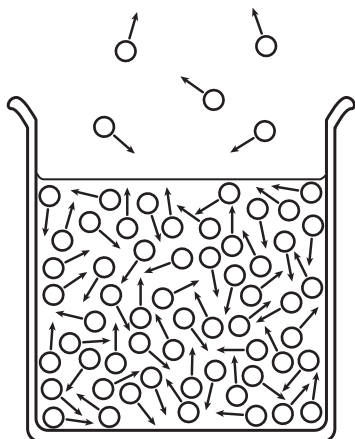
**14** If a sample has a mass of  $1.25 \times 10^2$  g and a volume of 51 mL, what is its density?

- F** 0.00025 g/mL
- G** 0.0125 g/mL
- H** 2.5 g/mL
- J** 250 g/mL

**15** What is the empirical formula of the compound with the molecular formula  $C_6H_{12}$ ?

- A** CH
- B**  $CH_2$
- C**  $CH_4$
- D**  $C_2H_6$

16



○ = Water molecule

The diagram shows water molecules in an open beaker and water molecules that have evaporated into the air above the beaker. Which change in this system will increase the rate of evaporation?

- F Adding salt to the water
- G Increasing the temperature of the water
- H Increasing the pressure of the air above the water
- J Increasing the humidity of the air above the water

17 A chemist is examining an unidentified element sample with oxidation states of +2, +3, and +6. The element has a shielding effect similar to that of potassium (K). Which statement about the unidentified element is *most* likely true?

- A It has the same number of neutrons as potassium.
- B It is a transition metal from the same period as potassium.
- C It is one of the heaviest elements in potassium's group.
- D It is a mix of three unstable isotopes of potassium.

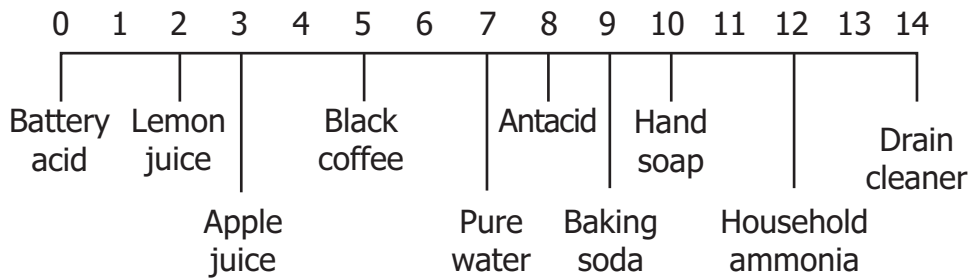


The reaction for the decomposition of ammonia ( $\text{NH}_3$ ) can be written as shown. If a student starts with 21.7 g of  $\text{NH}_3$ , how many grams of hydrogen ( $\text{H}_2$ ) gas will be produced by the reaction?

- F 1.28 g
- G 2.55 g
- H 3.85 g
- J 32.5 g

19 The product in a balanced reaction is  $4\text{Al}_2\text{O}_3$ . Which of the following shows the number of aluminum and oxygen atoms in  $4\text{Al}_2\text{O}_3$ ?

- A 8 atoms of aluminum and 3 atoms of oxygen
- B 6 atoms of aluminum and 3 atoms of oxygen
- C 8 atoms of aluminum and 12 atoms of oxygen
- D 6 atoms of aluminum and 7 atoms of oxygen



**According to the pH scale, which substance is slightly acidic?**

- F** Battery acid
- G** Black coffee
- H** Baking soda
- J** Drain cleaner

**21 Which of these is *most* likely to form between elements transferring electrons to form oppositely charged particles?**

- A** A metallic bond
- B** A hydrogen bond
- C** A covalent bond
- D** An ionic bond

**22 Which of the following is a chemical change?**

- F** Salt is dissolved in water.
- G** Water is boiled on a stove.
- H** Gasoline combusts in an engine.
- J** Copper metal is stretched into a long wire.

**23 The table shows the specific heat capacity of four substances.**

<b>Substance</b>	<b>Heat Capacity <math>\frac{\text{J}}{\text{g} \cdot ^\circ\text{C}}</math></b>
Aluminum	0.900
Glass	0.50
Carbon dioxide	0.843
Water	4.18

**For an equal mass of each substance, which one will require the *least* amount of heat to raise its temperature from 20°C to 30°C?**

- A** Aluminum
- B** Glass
- C** Carbon dioxide
- D** Water

24 What is the volume occupied by 51.0 g of ammonia ( $\text{NH}_3$ ) gas at STP?

- F 0.439 L
- G 22.8 L
- H 67.2 L
- J 91.9 L

25

**Molar Heat of Fusion and  
Melting Point for Selected Substances**

Substance	Melting Point ( $^{\circ}\text{C}$ )	$\Delta H_{\text{fus}}$ (kJ/mol)
Argon	-190	1.18
Benzene	5.5	9.87
Mercury	-39	2.29
Water	0	6.01

Which substance will release the greatest amount of heat when 1.00 mol is frozen?

- A Argon
- B Benzene
- C Mercury
- D Water

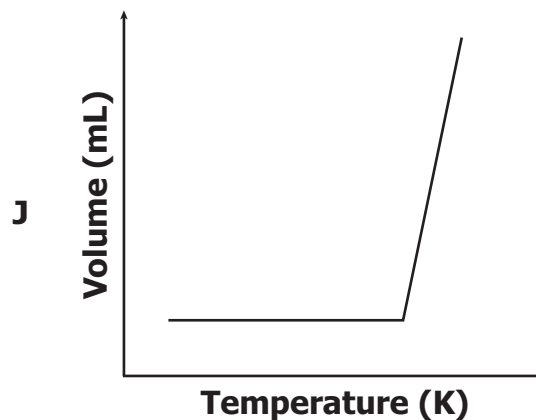
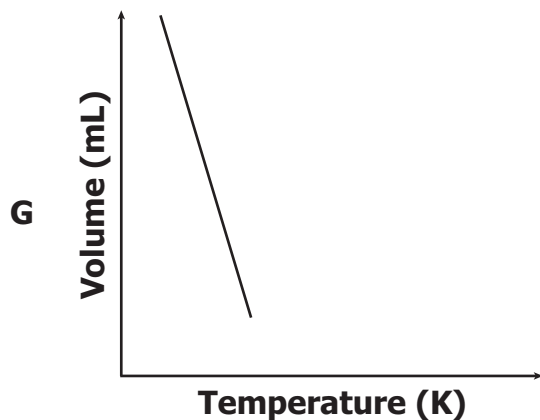
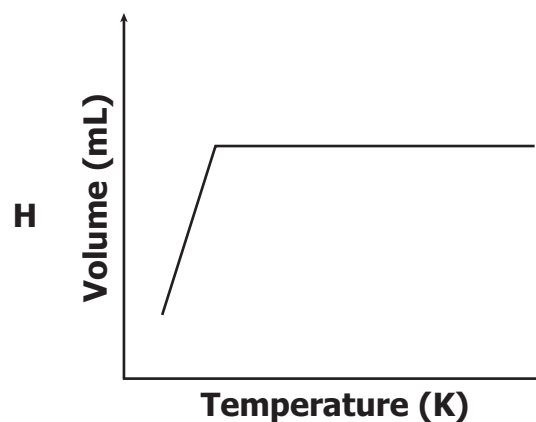
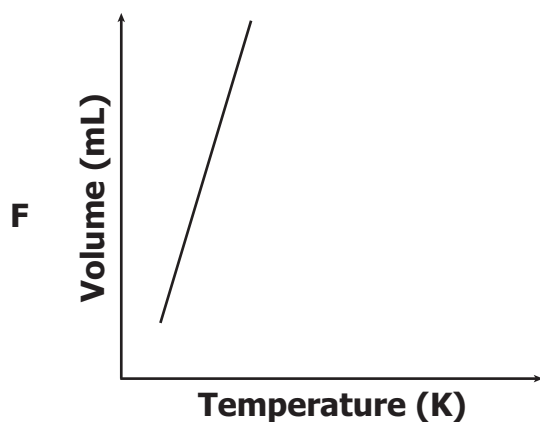
**26 A student hypothesizes that bromine (Br) has different chemical properties from krypton (Kr). The periodic table supports this hypothesis by indicating that —**

- F** bromine is a metal while krypton is a nonmetal
- G** one mole of bromine is heavier than one mole of krypton
- H** bromine and krypton are members of the same family
- J** bromine and krypton have different numbers of valence electrons

**27 A mixture of gases with a pressure of 800 mm Hg contains 10% oxygen and 90% nitrogen by volume. What is the partial pressure of the oxygen gas in the mixture?**

- A** 10 mm Hg
- B** 80 mm Hg
- C** 700 mm Hg
- D** 800 mm Hg

28 Which graph *best* shows the relationship between the volume of a gas and its temperature as the gas pressure remains constant?



29 One example of an ionic compound is —

- A  $F_2$
- B  $CO_2$
- C HBr
- D  $MgCl_2$



**Material Safety Data Sheet****Product Identification**

Chemical Q

**Hazard Identification**

Baker SAF-T DATA™ Ratings

Health: 2 – Moderate

Flammability: 3 – Severe

Reactivity: 1 – Slight

Contact: 1 – Slight

Hazard ratings are 0 to 4 (0 = no hazard, 4 = extreme hazard).

**Lab Protective Equipment:** Goggles and shield, lab coat and apron, vent hood, proper gloves, class B extinguisher

**Accidental Spill Instructions:** Ventilate area containing the spill. Absorb the chemical with inert material (vermiculite, sand) and place in proper chemical waste container. Do not place or pour down the drains.

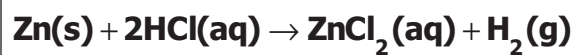
**A bottle of chemical Q spills on the floor. According to the MSDS, what is the proper response to this accident?**

- F** Letting the chemical evaporate by blowing fans on the spill
- G** Diluting the chemical with water, absorbing the liquid with inert material, and disposing of it in the trash
- H** Wiping up the chemical using paper towels and disposing of them in the trash
- J** Absorbing the chemical with inert material and disposing of it in a chemical waste container

**31** Le Chatelier's principle describes what happens to a system in equilibrium when a stress occurs. All of the following could shift an equilibrium EXCEPT —

- A** changing the pressure on the system
- B** changing the temperature of the system
- C** changing the identity of the catalyst
- D** changing the concentration of one of the components

**32**



**What type of reaction is shown?**

- F** Precipitation
- G** Neutralization
- H** Single replacement
- J** Double replacement

33 Hydrogen chloride is a covalent compound. Which is a correct Lewis dot structure for HCl?



34 Which is the *best* use for a fume hood?

- F Storing glassware
- G Removing toxic vapors
- H Covering volatile compounds
- J Mixing chemicals that release  $\text{O}_2$

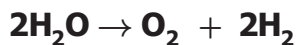
35 Which of the following equations is balanced?

- A  $\text{Na} + 2\text{Cl} \rightarrow 2\text{NaCl}_2$
- B  $2\text{Na} + \text{Cl}_2 \rightarrow \text{NaCl}_2$
- C  $\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$
- D  $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$

36 The specific heat of aluminum is  $0.900 \frac{\text{J}}{\text{g}\cdot^{\circ}\text{C}}$ . How much heat is required to raise the temperature of a 30.0 g block of aluminum from 25.0°C to 75.0°C?

- F 0.540 J
- G 1.50 J
- H 1350 J
- J 1670 J

37



When an electric current is passed through water, the reaction shown takes place. If the arrow were pointing in the opposite direction, what type of reaction would the new reaction represent?

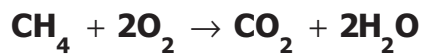
- A Single-replacement
- B Double-replacement
- C Synthesis
- D Decomposition

## Small Periodic Table Section

	1	2
3	X	4

The picture shows a small section of elements from the periodic table. Which element has one more proton than element X?

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



If 1.0 mole of methane reacts with oxygen to produce carbon dioxide and water, what mass of water is produced?

- A 16 grams
- B 18 grams
- C 36 grams
- D 44 grams

**40 An example of a chemical property is —**

- F** mass of a substance per unit volume
- G** ability to dissolve in solution
- H** point where solid becomes liquid
- J** tendency to undergo oxidation

**41 Students want to separate and compare the components of black ink and green ink. Which technique is the *best* for the students to use?**

- A** Chromatography
- B** Decanting
- C** Filtration
- D** Evaporation

**42 When 80 g of sodium hydroxide, NaOH, are dissolved in enough water to make 500 mL of solution, the molarity of the solution is —**

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

**43** What is the name for the compound  $\text{CaSO}_4$ ?

- A** Calcium sulfate
- B** Calcium sulfide
- C** Calcium sulfur oxide
- D** Calcium sulfur oxygen

**44** If the pH of a solution is 4, what is the pOH?

- F** 0
- G** 6
- H** 7
- J** 10

**45** A student attempts to measure the specific heat capacity of an unknown liquid through repeated trials. She measures its specific heat capacity, in  $\frac{\text{J}}{\text{g}\cdot^{\circ}\text{C}}$ , as 2.14, 2.11, 2.13, 2.12, and 2.11. The specific heat capacity of the liquid should be recorded as —

**A**  $2 \frac{\text{J}}{\text{g}\cdot^{\circ}\text{C}}$

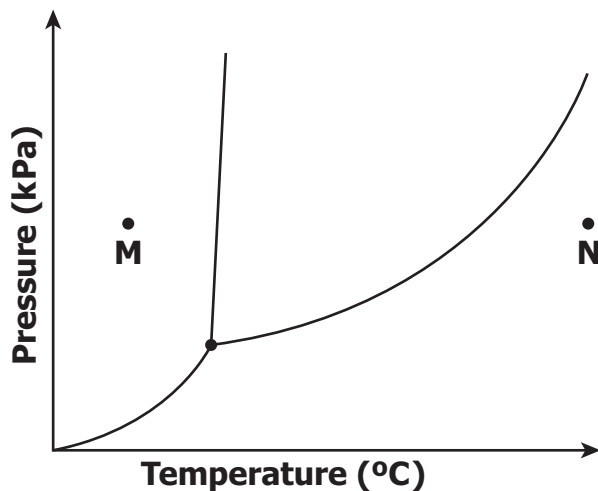
**B**  $2.1 \frac{\text{J}}{\text{g}\cdot^{\circ}\text{C}}$

**C**  $2.12 \frac{\text{J}}{\text{g}\cdot^{\circ}\text{C}}$

**D**  $2.122 \frac{\text{J}}{\text{g}\cdot^{\circ}\text{C}}$



Phase Diagram for Compound X



If the temperature changes from point M to point N, at constant pressure, compound X undergoes —

- F one phase change
- G two phase changes
- H three phase changes
- J no change in phase

47 Which of these *best* describes the basis on which new scientific ideas are accepted or rejected?

- A Popular support
- B Historical support
- C Compelling evidence
- D Moral and ethical beliefs

**48** Based on its position in the periodic table, the element sulfur would be expected to have how many valence electrons?

- F** 4
- G** 6
- H** 8
- J** 16

**49** The number of molecules in 48.0 grams of oxygen gas ( $O_2$ ) is —

- A**  $6.02 \times 10^{23}$
- B**  $9.03 \times 10^{23}$
- C**  $1.20 \times 10^{24}$
- D**  $1.81 \times 10^{24}$

**50** A student determined that the density of a sample of tin is 8.00 g/mL, when the actual density of tin is 7.28 g/mL. What was the percent error in the student's calculation?

- F** 0.72%
- G** 9.0%
- H** 9.9%
- J** 91%



**Answer Key-EOC015-S0119**

<b>Test Sequence Number</b>	<b>Correct Answer</b>	<b>Reporting Category</b>	<b>Reporting Category Description</b>
1	D	001	Scientific Investigation
2	J	002	Atomic Structure and Periodic Relationships
3	A	003	Nomenclature, Chemical Formulas, and Reactions
4	H	001	Scientific Investigation
5	A	003	Nomenclature, Chemical Formulas, and Reactions
6	F	003	Nomenclature, Chemical Formulas, and Reactions
7	D	003	Nomenclature, Chemical Formulas, and Reactions
8	J	004	Molar Relationships
9	D	003	Nomenclature, Chemical Formulas, and Reactions
10	G	002	Atomic Structure and Periodic Relationships
11	A	003	Nomenclature, Chemical Formulas, and Reactions
12	F	001	Scientific Investigation
13	B	005	Phases of Matter and Kinetic Molecular Theory
14	H	001	Scientific Investigation
15	B	003	Nomenclature, Chemical Formulas, and Reactions
16	G	005	Phases of Matter and Kinetic Molecular Theory
17	B	002	Atomic Structure and Periodic Relationships
18	H	004	Molar Relationships
19	C	003	Nomenclature, Chemical Formulas, and Reactions
20	G	004	Molar Relationships
21	D	003	Nomenclature, Chemical Formulas, and Reactions
22	H	002	Atomic Structure and Periodic Relationships
23	B	005	Phases of Matter and Kinetic Molecular Theory
24	H	004	Molar Relationships
25	B	005	Phases of Matter and Kinetic Molecular Theory
26	J	002	Atomic Structure and Periodic Relationships
27	B	005	Phases of Matter and Kinetic Molecular Theory
28	F	005	Phases of Matter and Kinetic Molecular Theory
29	D	003	Nomenclature, Chemical Formulas, and Reactions
30	J	001	Scientific Investigation
31	C	003	Nomenclature, Chemical Formulas, and Reactions
32	H	003	Nomenclature, Chemical Formulas, and Reactions
33	B	003	Nomenclature, Chemical Formulas, and Reactions
34	G	001	Scientific Investigation
35	D	003	Nomenclature, Chemical Formulas, and Reactions
36	H	005	Phases of Matter and Kinetic Molecular Theory
37	C	003	Nomenclature, Chemical Formulas, and Reactions
38	J	002	Atomic Structure and Periodic Relationships
39	C	004	Molar Relationships
40	J	002	Atomic Structure and Periodic Relationships
41	A	001	Scientific Investigation
42	H	004	Molar Relationships
43	A	003	Nomenclature, Chemical Formulas, and Reactions
44	J	004	Molar Relationships
45	C	001	Scientific Investigation
46	G	005	Phases of Matter and Kinetic Molecular Theory
47	C	001	Scientific Investigation
48	G	002	Atomic Structure and Periodic Relationships
49	B	004	Molar Relationships
50	H	001	Scientific Investigation

### Chemistry, Core 1

If you get this many items correct:	Then your converted scale score is:
0	000
1	199
2	232
3	252
4	267
5	279
6	290
7	298
8	306
9	314
10	320
11	327
12	333
13	338
14	343
15	349
16	353
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21	376
22	381
23	385
24	389
25	394
26	398
<b>27</b>	<b>402</b>
28	407
29	411
30	415
31	420
32	424
33	429
34	434
35	439
36	444
37	449
38	455
39	460
40	467
41	473
42	480
43	488
44	497
<b>45</b>	<b>507</b>
46	519
47	533
48	553
49	586
50	600

