

VIRGINIA STANDARDS OF LEARNING

Spring 2007 Released Test

END OF COURSE CHEMISTRY

Form S0117, CORE 1

Property of the Virginia Department of Education

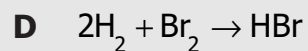
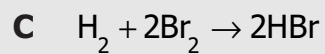
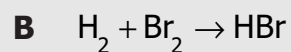
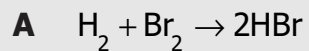
©2007 by the Commonwealth of Virginia, Department of Education, P.O. Box 2120, Richmond, Virginia 23218-2120. All rights reserved. Except as permitted by law, this material may not be reproduced or used in any form or by any means, electronic or mechanical, including photocopying or recording, or by any information storage or retrieval system, without written permission from the copyright owner. Commonwealth of Virginia public school educators may reproduce any portion of these released tests for non-commercial educational purposes without requesting permission. All others should direct their written requests to the Virginia Department of Education, Division of Student Assessment and School Improvement, at the above address or by e-mail to Student_Assessment@doe.virginia.gov.

Directions

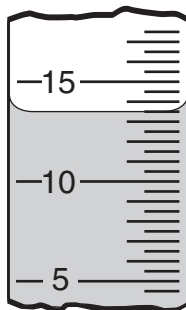
Read each question carefully and choose the best answer. Then mark the space on your answer document for the answer you have chosen.

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

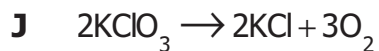
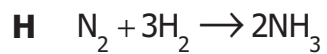
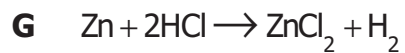
3

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

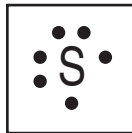
What is the mass of a mole of Ca(OH)_2 ?

- 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:



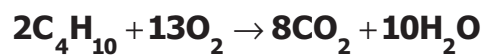
Which of the elements has the same Lewis structure?

- 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

7



The equation shows the combustion of butane (C_4H_{10}). How many moles of water can be produced by 12.5 moles of C_4H_{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 MgCl_2
- G MnCl
- H Mg_2Cl_3
- J 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 ₂ O	40.7 kJ/mole
NH ₃	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°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?

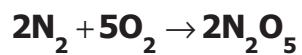
F $10.0\text{mL} \times \frac{7.87\text{g}}{1\text{mL}}$

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?

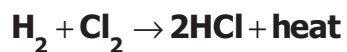
A 2.8 g

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 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 (°C)	Reading 2 (°C)	Reading 3 (°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°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

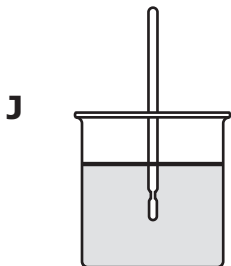
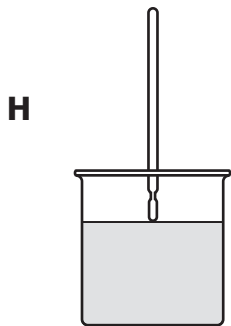
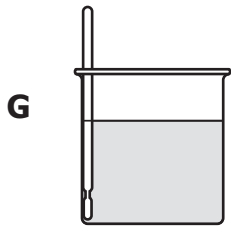
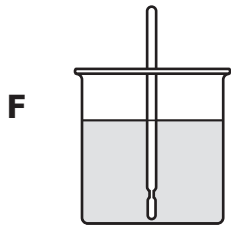
20 Catalytic converters made of palladium (Pd) reduce automobile pollution by catalyzing the reaction between unburned hydrocarbons and oxygen. How does Pd increase the rate of this reaction?

- 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 (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?



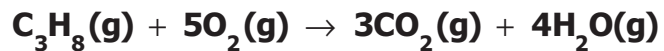
O 3.5	F 4.0
S 2.5	Cl ?
Se 2.4	Br 2.8

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 CaI_2
- G KBr
- H NaCl
- J NO



If 5.0 moles of C_3H_8 react, how many molecules of water are formed?

- A 3.0×10^{24}
- B 4.8×10^{24}
- C 1.2×10^{25}
- D 2.4×10^{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.

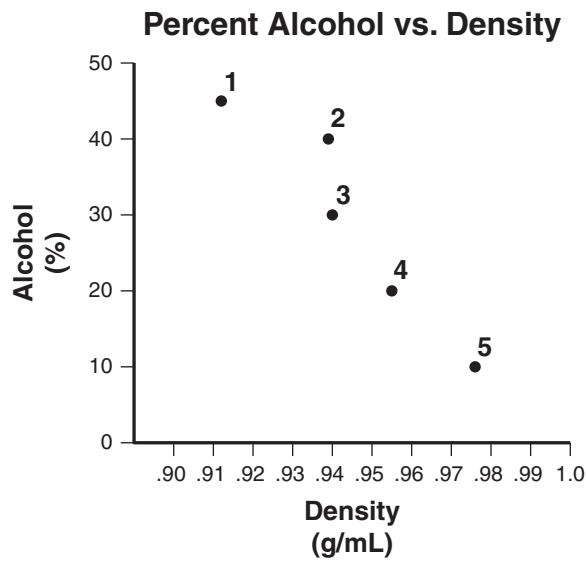
30 Sulfuric acid (H_2SO_4) is spilled on a laboratory bench. Which chemical would be useful for neutralizing the acid?

- F** Aluminum chloride (AlCl_3)
- G** Potassium nitrate (KNO_3)
- H** Silver iodide (AgI)
- J** Sodium bicarbonate (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

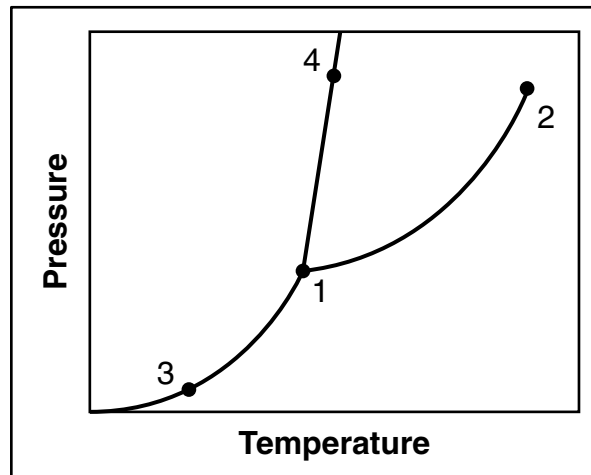
33 What is the chemical name for the compound P_3N_5 ?

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

34 In 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**

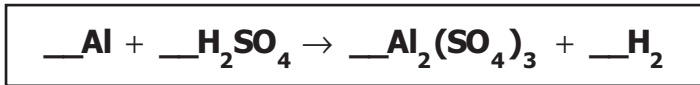
Gas	Partial Pressure (mm Hg)
Ar	7.10
CO ₂	?
N ₂	593.44
O ₂	159.20
Others	0.02

If the total atmospheric pressure is 760.00 mm Hg, what is the partial pressure of CO₂?

- 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?

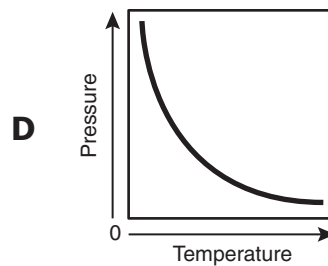
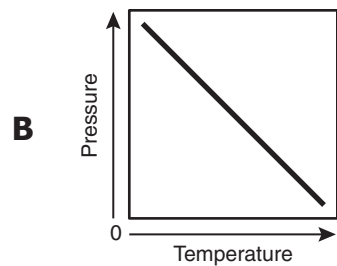
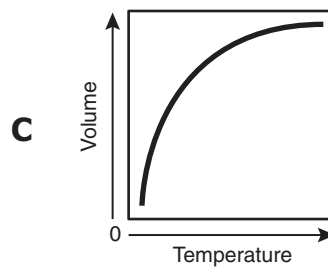
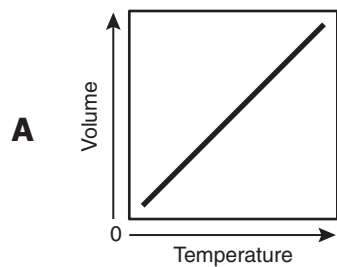
- A** Wearing long hair down
- B** Having safety goggles within reach
- C** Pointing the test tube away from people
- D** Keeping the test tube securely stoppered



When the equation is correctly balanced, the coefficient of H_2SO_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:

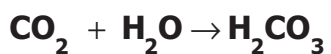
- 1. Planetary model**
- 2. Quantum mechanical model**
- 3. Solid sphere model**

- 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



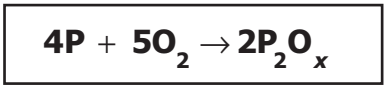
The reaction is which type of chemical reaction?

- 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** 5.65×10^{11}
- C** 56.5×10^{10}
- D** 565×10^9

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** AlCl_3
- B** Al_3Cl
- C** Al_2Cl_3
- D** AlCl

50



NO_2 and N_2O_4 undergo the reaction shown. When a sealed container of NO_2 reaches chemical equilibrium, which must be true?

- F** No N_2O_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.



Answer Key-EOC015-S0117

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

Chemistry, Core 1

If you get this many items correct:	Then your converted scale score is:
0	000
1	188
2	221
3	242
4	257
5	269
6	279
7	289
8	297
9	304
10	311
11	318
12	324
13	329
14	335
15	340
16	345
17	350
18	355
19	360
20	364
21	369
22	373
23	378
24	382
25	387
26	391
27	395
28	400
29	404
30	409
31	413
32	418
33	423
34	428
35	433
36	438
37	443
38	449
39	455
40	461
41	468
42	475
43	483
44	491
45	502
46	513
47	528
48	548
49	581
50	600