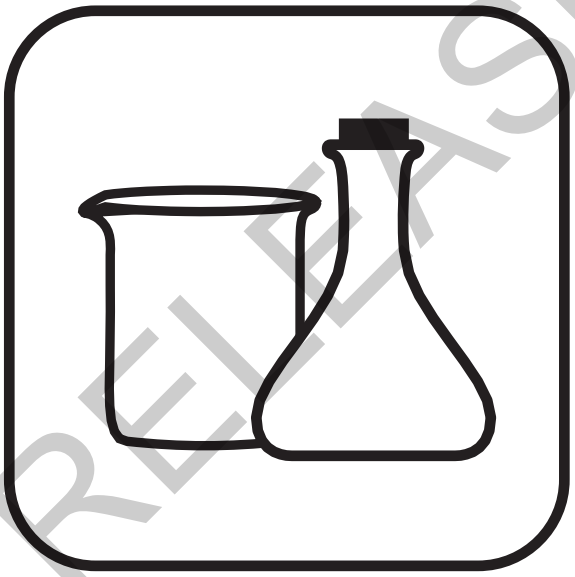
Released Items

Student Name:_____

Chemistry



2016–2017

NC Final Exam

Public Schools of North Carolina
State Board of Education
Department of Public Instruction
Raleigh, North Carolina 27699-6314

1 What is the chemical formula for magnesium bromate?

A $MgBr$

B $MgBr_2$

C $MgBrO_3$

D $Mg(BrO_3)_2$

2 How are compounds with metallic bonds similar to ionic compounds?

A Both tend to have double and triple bonds.

B Both tend to have low boiling points.

C Both tend to have poor conductivity.

D Both tend to have high melting points.

3 Which of these elements has the greatest atomic radius?

A H

B N

C Cl

D Cs

4 How does the amount of heat energy change as a 250-g sample of water is heated from 5.0°C to 30.0°C?

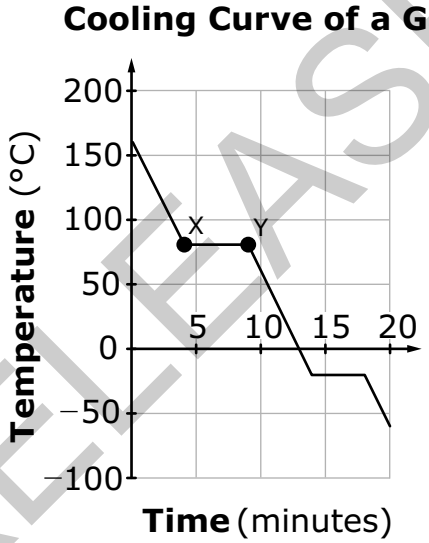
A The amount of heat energy increases, causing the water to sublime.

B The amount of heat energy increases, causing the water to evaporate.

C As the temperature increases, the amount of heat energy decreases.

D As the temperature increases, the amount of heat energy increases.

5 This graph represents data collected when a sample of a gas is uniformly cooled from 155°C.



Why does the temperature of the sample remain constant between point X and point Y?

A because the sample is transitioning from a gaseous state to a solid state

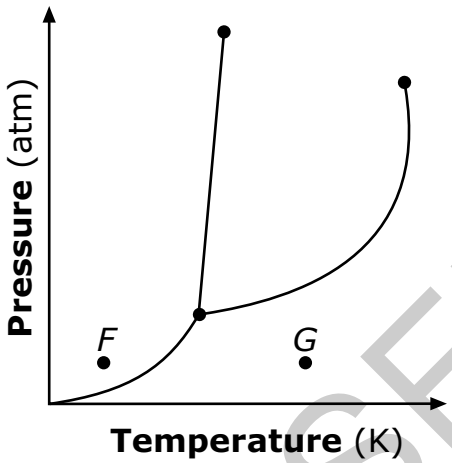
B because the sample is transitioning from a gaseous state to a liquid state

C because the sample is transitioning from a solid state to a gaseous state

D because the sample is transitioning from a liquid state to a solid state

6 The phases of a substance under various pressure and temperature combinations are shown on this phase diagram.

Phase Diagram of a Substance



What occurs if the pressure of the substance at point *F* remains constant, and the temperature increases to point *G*?

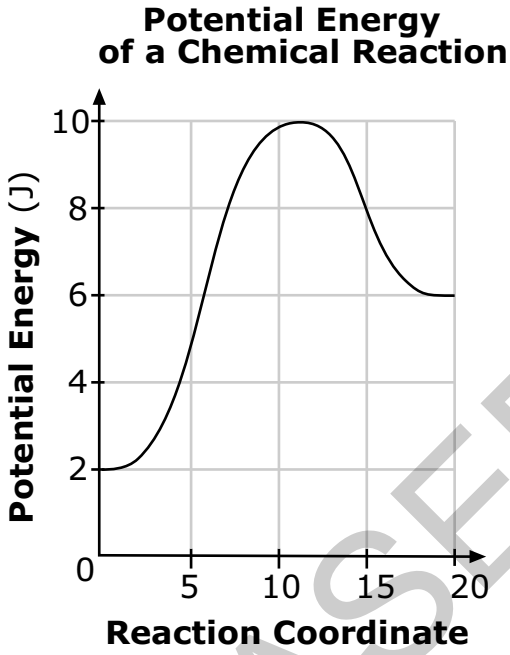
A It will transition from a solid state to a liquid state.

B It will transition from a liquid state to a solid state.

C It will transition from a solid state to a gaseous state.

D It will transition from a gaseous state to a solid state.

7 The potential energy diagram of a chemical reaction is shown below.



Which ***best*** describes the energy in the chemical reaction?

A Heat energy was released.

B Energy was lowered by a catalyst.

C 8 J of energy were required to start the reaction.

D 10 J of energy were required to start the reaction.

Go to the next page.

8 This balanced chemical equation represents a chemical reaction:

$$6NO + 4NH_3 \rightarrow 5N_2 + 6H_2O$$

What volume of NH_3 gas, at Standard Temperature and Pressure (STP), is required to react with 15.0 g of NO?

A 5.68 L

B 7.47 L

C 10.0 L

D 11.2 L

9 The equation represents a chemical reaction at equilibrium.

$$HCl\ (aq) + Mg\ (s) \rightleftarrows MgCl_2\ (aq) + H_2\ (g) + \text{heat}$$

What happens to the system when the temperature is decreased?

A The reaction shifts toward the right, and the amount of hydrogen gas increases.

B The reaction shifts toward the right, and the amount of hydrogen gas decreases.

C The reaction shifts toward the left, and the amount of hydrogen gas increases.

D The reaction shifts toward the left, and the amount of hydrogen gas decreases.

Go to the next page.

10 This equation represents a chemical reaction at equilibrium:

$$2SO_2\ (g) + O_2\ (g) \rightleftarrows 2SO_3\ (g)$$

What will happen when the concentration of SO_3 is increased?

A The reaction shifts to the right, and concentrations of SO_2 (g) and O_2 (g) decrease.

B The reaction shifts to the right, and concentrations of SO_2 (g) and O_2 (g) increase.

C The reaction shifts to the left, and concentrations of SO_2 (g) and O_2 (g) decrease.

D The reaction shifts to the left, and concentrations of SO_2 (g) and O_2 (g) increase.

11 A student conducts an experiment to identify the pH of some common household substances. The data is recorded in this table.

pH Values for Common Household Substances

Substance	pH
Ammonia	11.9
Drain Cleaner	13.5
Hand Soap	10.1
Lemon Juice	2.3
Vinegar	3.0
Water	6.8

Which substance would be classified as containing the highest concentration of hydroxide ions?

A Ammonia

B Drain Cleaner

C Lemon Juice

D Vinegar

12 A newly synthesized ionic compound is placed in water to make an aqueous solution. Which ***best*** describes the new ionic solution?

A The ionic solution conducts electricity.

B The ionic solution dissolves nonpolar solutions.

C The ionic solution cannot conduct electricity.

D The ionic solution is a neutral solution.

13 Why is potassium chloride able to dissolve in water?

A because potassium ions are attracted to the partial negative charge of hydrogen

B because potassium ions are attracted to the partial positive charge of hydrogen

C because potassium ions are attracted to the partial negative charge of oxygen

D because potassium ions are attracted to the partial positive charge of oxygen

14 Which occurs if an electron transitions from $n = 5$ to $n = 2$ in a hydrogen atom?

A Energy is absorbed, and visible light is emitted.

B Energy is released, and visible light is emitted.

C Energy is released, and visible light is not emitted.

D Energy is absorbed, and visible light is not emitted.

15 When a gamma ray is emitted by an element, what happens to the atomic mass and the atomic number?

A The atomic mass stays the same, and the atomic number stays the same.

B The atomic mass changes, and the atomic number stays the same.

C The atomic mass stays the same, and the atomic number changes.

D The atomic mass changes, and the atomic number changes.

16 How does a single covalent bond between two carbon atoms compare to a double covalent bond between two carbon atoms?

A A single covalent bond is stronger and has a longer bond length than a double covalent bond.

B A single covalent bond is stronger and has a shorter bond length than a double covalent bond.

C A single covalent bond is weaker and has a shorter bond length than a double covalent bond.

D A single covalent bond is weaker and has a longer bond length than a double covalent bond.

17 How do the three isotopes Sn-116, Sn-118, and Sn-119 differ?

A Sn-116 has 166 neutrons, Sn-118 has 168 neutrons, and Sn-119 has 169 neutrons.

B Sn-116 has 116 neutrons, Sn-118 has 118 neutrons, and Sn-119 has 119 neutrons.

C Sn-116 has 66 neutrons, Sn-118 has 68 neutrons, and Sn-119 has 69 neutrons.

D Sn-116 has 50 neutrons, Sn-118 has 52 neutrons, and Sn-119 has 53 neutrons.

18 Which molecule contains a triple bond?

A F_2

B O_2

C Cl_2

D N_2

Go to the next page.

19 Which of these compounds will form a precipitate when mixed with an aqueous solution of sodium sulfate, Na_2SO_4?

A $LiNO_3$

B KNO_3

C $Mg(NO_3)_2$

D $Ba(NO_3)_2$

20 Solid chromium(II) reacts with oxygen gas to form solid CrO. What is this type of reaction?

A decomposition

B synthesis

C single replacement

D double replacement

21 Which element has 8 valence electrons?

A potassium

B oxygen

C helium

D neon

22 How are the bonds formed in a polar covalent compound?

A Electrons are shared unequally.

B Electrons are shared equally.

C Electrons are gained.

D Electrons are lost.

23 In a chemical reaction, how does increasing the temperature of the reactants affect the reaction process?

A The reactants absorb more heat, which turns them into products faster.

B The activation energy is decreased, which makes the reaction proceed faster.

C The kinetic energy of the reactants increases, causing more effective collisions.

D The particles break down faster, increasing the surface area and the reaction rate.

Chemistry
RELEASED Items[1]
2016–2017
Answer Key

Question Number	Question Type[2]	Correct Answer	Percent Correct[3]	Objective
1	MC	D	59%	Chm.1.2.4
2	MC	D	65%	Chm.1.2.5
3	MC	D	73%	Chm.1.3.2
4	MC	D	65%	Chm.2.1.2
5	MC	B	82%	Chm.2.1.2
6	MC	C	56%	Chm.2.1.3
7	MC	C	20%	Chm.2.2.1
8	MC	B	48%	Chm.2.2.4
9	MC	A	34%	Chm.3.1.3
10	MC	D	45%	Chm.3.1.3
11	MC	B	53%	Chm.3.2.1
12	MC	A	48%	Chm.3.2.4
13	MC	C	56%	Chm.3.2.6
14	MC	B	67%	Chm.1.1.3
15	MC	A	32%	Chm.1.1.4
16	MC	D	52%	Chm.1.2.1

Question Number	Question Type[2]	Correct Answer	Percent Correct[3]	Objective
17	MC	C	62%	Chm.1.1.1
18	MC	D	45%	Chm.1.2.2
19	MC	D	28%	Chm.2.2.2
20	MC	B	83%	Chm.2.2.3
21	MC	D	61%	Chm.1.1.2
22	MC	A	34%	Chm.1.2.5
23	MC	C	50%	Chm.3.1.1

[1]These released items were administered to students during a previous test administration. This sample set of released items may not reflect the breadth of the standards assessed and/or the range of item difficulty found on the NC Final Exam. Additional information about the NC Final Exam is available in the *Assessment Specification* for each exam located at http://www.ncpublicschools.org/accountability/common-exams/specifications/.

[2]This NC Final Exam contains only multiple-choice (MC) items.

[3]Percent correct is the percentage of students who answered the item correctly during a previous administration.

Clarifying Objectives Descriptions

Only clarifying objective descriptions addressed by the released items in this document are listed below. A complete list of North Carolina *Essential Standards* for Science may be reviewed at http://www.ncpublicschools.org/curriculum/science/scos/support-tools/#standards.

Chm.1.1.1
Analyze the structure of atoms, isotopes, and ions.

Chm.1.1.2
Analyze an atom in terms of the location of electrons.

Chm.1.1.3
Explain the emission of electromagnetic radiation in spectral form in terms of the Bohr model.

Chm.1.1.4
Explain the process of radioactive decay by the use of nuclear equations and half-life.

Chm.1.2.1
Compare (qualitatively) the relative strengths of ionic, covalent, and metallic bonds.

Chm.1.2.2
Infer the type of bond and chemical formula formed between atoms.

Chm.1.2.4
Interpret the name and formula of compounds using IUPAC convention.

Chm.1.2.5
Compare the properties of ionic, covalent, metallic, and network compounds.

Chm.1.3.2
Infer the physical properties (atomic radius, metallic and nonmetallic characteristics) of an element based on its position on the Periodic Table.

Chm.2.1.2
Explain heating and cooling curves (heat of fusion, heat of vaporization, heat, melting point, and boiling point).

Chm.2.1.3
Interpret the data presented in phase diagrams.

Chm.2.2.1
Understand the energy content of a chemical reaction.

Chm.2.2.2
Analyze the evidence of chemical change.

Chm.2.2.3
Analyze the law of conservation of matter and how it applies to various types of chemical equations (synthesis, decomposition, single replacement, double replacement, and combustion).

Chm.2.2.4
Analyze the stoichiometric relationships inherent in a chemical reaction.

Chm.3.1.1
Explain the factors that affect the rate of a reaction (temperature, concentration, particle size and presence of a catalyst).

Chm.3.1.3
Infer the shift in equilibrium when a stress is applied to a chemical system (Le Chatelier's Principle).

Chm.3.2.1
Classify substances using the hydronium and hydroxide ion concentrations.

Chm.3.2.4
Summarize the properties of solutions.

Chm.3.2.6
Explain the solution process.