

**VIRGINIA
STANDARDS OF LEARNING ASSESSMENTS**

Spring 2002 Released Test

**END OF COURSE
CHEMISTRY**

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DIRECTIONS

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

SAMPLE

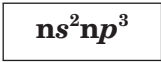
Which of the following is a balanced equation?

- A $H_2 + Br_2 \rightarrow 2HBr$
- B $H_2 + Br_2 \rightarrow HBr$
- C $H_2 + 2Br_2 \rightarrow 2HBr$
- D $2H_2 + Br_2 \rightarrow HBr$

1 Which of the following pieces of glassware can be used to measure the volume of a liquid with the greatest accuracy?

- A Test tube
- B Beaker
- C Flask
- D Graduated cylinder

2



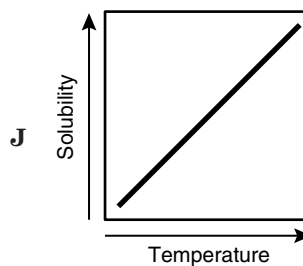
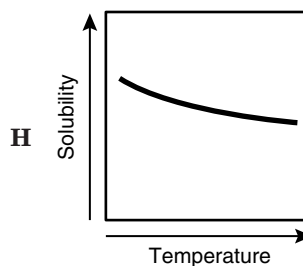
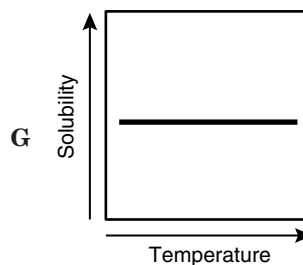
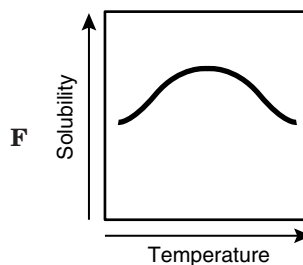
Which of these elements is found in a family with the above electron configuration?

- F Al
- G Sr
- H Si
- J Sb

3 Which of the following equations is balanced?

- A $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + H_2O$
- B $CH_4 + Cl_2 \rightarrow CH_2Cl_2 + HCl$
- C $H_2O + MgO \rightarrow Mg(OH)_2$
- D $Al(OH)_3 + H_3PO_4 \rightarrow AlPO_4 + 2H_2O$

4 Most gases have the property of becoming increasingly soluble in a liquid as the temperature of the liquid decreases. Which graph shows this relationship?



5 How is 0.00124 expressed in proper scientific notation?

- A 1.24×10^{-3}
- B 0.124×10^{-2}
- C 1.24
- D 1.24×10^3

6 How many protons, neutrons, and electrons are in a neutral atom of sodium?

- F 11 p⁺, 12 n[°], 11e⁻
- G 11 p⁺, 11 n[°], 12e⁻
- H 12 p⁺, 11 n[°], 12e⁻
- J 12 p⁺, 11 n[°], 11e⁻

7 The system that shows a decrease in entropy (disorder) is —

- A air escaping from a tire
- B snow melting
- C salt dissolving in water
- D water freezing

8 The pH of a 0.1 molar aqueous solution of HCl would equal —

- F -1
- G 1
- H 11
- J 13

9 A catalyst is a substance used in chemical reactions to —

- A provide a higher activation energy pathway
- B decrease collisions between reactant molecules
- C increase the rate of the reaction
- D change the equilibrium to favor products

- 10 A student measures the mass of a piece of copper three times and records the results in the following table:

Trial	Mass (grams)
1	26.5
2	26.4
3	26.5

The actual mass of the copper is 28.7 grams. Which of the following is demonstrated in the student's data?

- F Accuracy
- G Continuity
- H Precision
- J Reliability

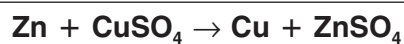
- 11 Which grouping identifies chemical properties?

- A Malleability, ductility, conductivity
- B Luster, hardness, texture
- C Combustibility, flammability, reactivity
- D Density, melting point, boiling point

- 12 From left to right across a period, what change is occurring within the atomic nuclei?

- F A proton is gained.
- G An electron is gained.
- H A neutron is lost.
- J The electron cloud size is decreasing.

13



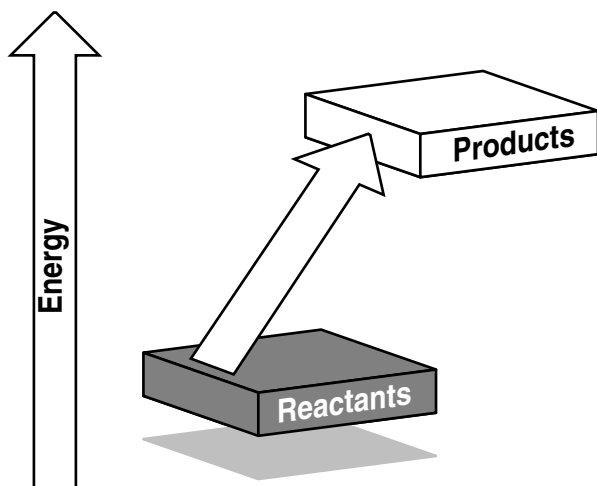
Which reaction type *best* describes the reaction above?

- A Combination
- B Decomposition
- C Single replacement
- D Combustion

14 If the heat of fusion is 32.2 kJ/mol, the amount of heat energy required to melt 5.67 grams of FeO is —

- F 2.54 kJ
- G 3.26 kJ
- H 5.32 kJ
- J 18.3 kJ

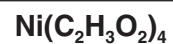
15



This diagram of a chemical reaction shows that the reaction is —

- A endothermic
- B exothermic
- C reversible
- D at equilibrium

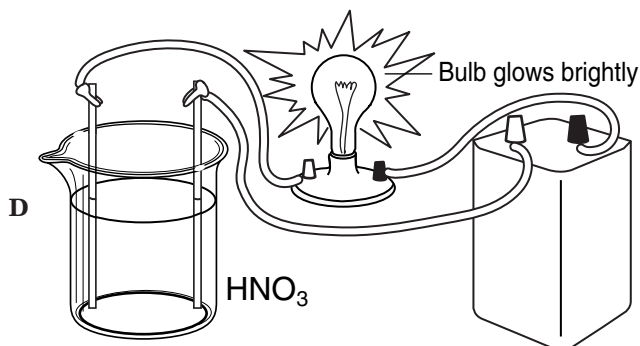
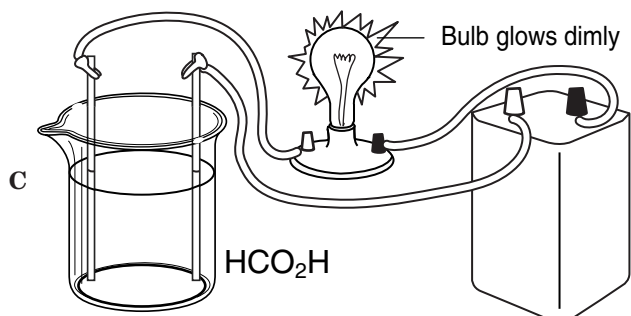
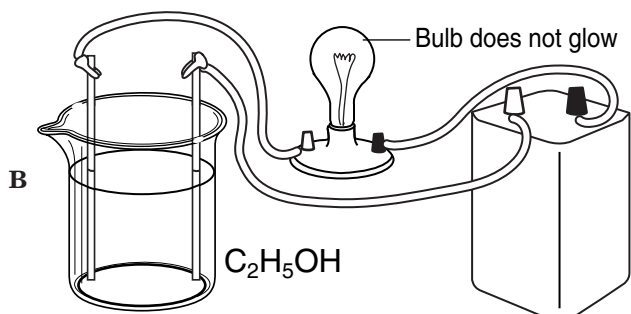
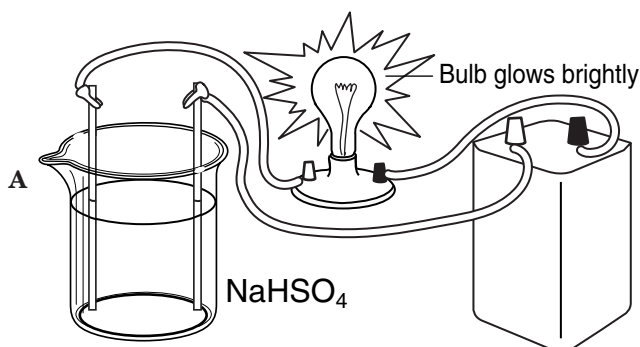
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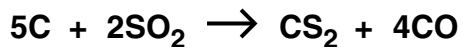
How many atoms are represented in this formula?

- F 5
- G 8
- H 28
- J 29

17 Which of the following substances is a *weak* electrolyte?



18



Carbon disulfide is prepared industrially by reacting carbon with sulfur dioxide according to the above equation. If 5.9 moles of carbon react, how many moles of CS₂ are produced?

- F 0.077 moles
- G 1.2 moles
- H 1.5 moles
- J 30 moles

19 Water has several unique properties such as high boiling point, high surface tension, and low vapor pressure. The type of attraction that *best* accounts for these unique properties is —

- A dispersion forces
- B coordinate covalent bonding
- C hydrogen bonding
- D ionic bonding

20 Which of these reactions shows simple chemical decomposition?

- F $\text{H}_2 + \text{I}_2 \rightarrow 2\text{HI}$
- G $2\text{NaCl} \rightarrow 2\text{Na} + \text{Cl}_2$
- H $\text{NaF} + \text{HCl} \rightarrow \text{HF} + \text{NaCl}$
- J $\text{I}_2 + 2\text{NaCl} \rightarrow 2\text{NaI} + \text{Cl}_2$

21 To determine the density of corn syrup, a student poured 3.0 mL of the liquid into a 10.0 mL graduated cylinder and massed the cylinder and contents. He determined the density to be 10.5 g/cm^3 . The accepted value for the density of corn syrup is 1.38 g/cm^3 . The *most* probable cause of error was that —

- A the mass and the volume were multiplied
- B the mass of the cylinder was included in the density formula
- C the graduated cylinder accuracy is only $+0.5 \text{ mL}$
- D the mass and volume were inverted in the density formula

22

Procedure	Initial Volume (m^3)		Final Volume (m^3)		
	N_2	H_2	N_2	H_2	NH_3
A	1000	3000	600	1800	800
B	1000	3000	250	750	1500
C	1000	3000	450	1350	1100
D	1000	3000	375	1125	1250

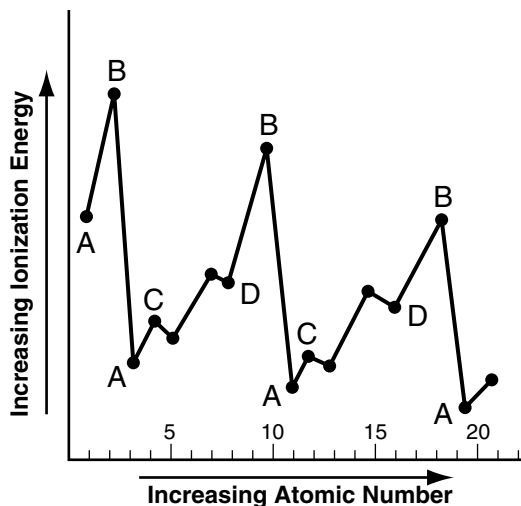
A chemical engineer for a fertilizer company is determining the most efficient way to produce ammonia. The engineer carries out the Haber reaction under four different conditions. According to these data, which procedure gave the greatest percent yield?

- F A
- G B
- H C
- J D

23 The understanding that the position of an electron in an electron cloud cannot precisely be determined was developed by Werner Heisenberg and is known as the —

- A planetary model
- B uncertainty principle
- C quantum theory
- D first atomic theory

24



The chart above shows the relationship between the first ionization potential and the increase in atomic number. The letter on the chart that indicates the noble gases or the inert elements is —

- F A
- G B
- H C
- J D

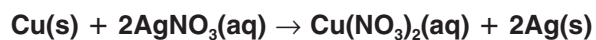
25 The Lewis electron dot system represents electrons in the —

- A outer energy level
- B inner level
- C middle level
- D core level

26 The correct name for MgI_2 is —

- F magnesium iodide
- G magnesium iodite
- H magnesium (II) iodide
- J magnesium diiodide

27



When copper reacts with silver nitrate according to the equation, the number of grams of copper required to produce 432 grams of silver is —

- A 31.5 g
- B 127 g
- C 216 g
- D 252 g

28 What is the final concentration if 50.0 mL of a 2.00 M solution are diluted to 500.0 mL?

- F 0.100 M
- G 0.200 M
- H 0.400 M
- J 1.00 M

29

Metal	Melting Point (°C)	Boiling Point (°C)
Copper	1083	2595
Iron	1535	3000
Lead	327	1744
Platinum	1769	4530

The table above lists the melting and boiling points of some metals. Which metal remains liquid over the widest range of temperature?

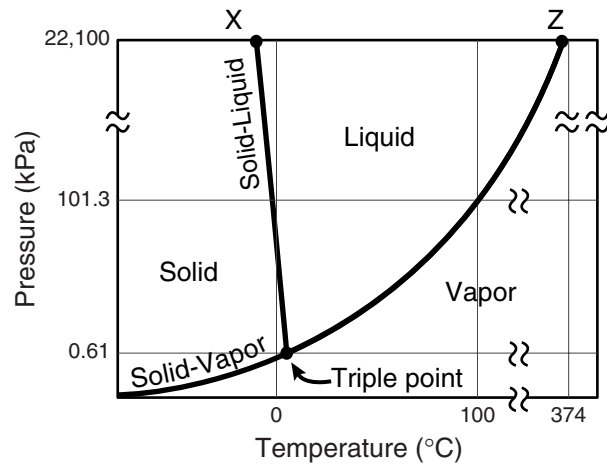
- A Copper
- B Iron
- C Lead
- D Platinum

30 Isotopes of an element have different —

- F atomic numbers
- G atomic masses
- H numbers of protons
- J numbers of outer-shell electrons

31

Triple Point of Water



According to the graph above, what happens at the triple point of water?

- A Only ice and liquid water exist in equilibrium.
- B Water exists only as a solid.
- C Water exists only as a gas.
- D Ice, water vapor, and liquid water exist in equilibrium.

32

$$R = 8.31 \frac{\text{kPa} \cdot \text{dm}^3}{\text{moles} \cdot \text{K}}$$

A gas cylinder with a volume of 3.00 dm^3 contains 8.00 moles of oxygen gas at a temperature of 50.0 K . What is the pressure inside the cylinder?

- F 504 kPa
- G 1110 kPa
- H 2220 kPa
- J 3320 kPa

33 When examining the physical properties of an unknown substance, which of the following characteristics is unsafe to observe?

- A Color
- B Weight
- C Form
- D Taste

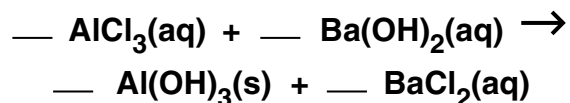
34 The density of an unknown metal was determined to be 2.85 g/mL . The actual density was 2.70 g/mL . What is the percent error in this determination?

- F 0.056%
- G 0.15%
- H 5.6%
- J 94.4%

35 The empirical formula for ethyne (C_2H_2) is —

- A CH
- B C_2H_2
- C CH_2
- D C_2H

36



When this equation is correctly balanced, the coefficient of the AlCl_3 will be —

- F 1
- G 2
- H 4
- J 6

37



How many liters of oxygen are required to produce 2 liters of water at STP?

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

38

	Trials			
	1	2	3	4
Temperature	18°C	18°C	18°C	18°C
Amount of Catalyst	3 mg	2 mg	1 mg	0 mg
Amount of A	5 g	5 g	5 g	5 g
Amount of B	7 g	7 g	7 g	7 g
Time	10 min	10 min	10 min	10 min

A student designed this experiment to study the effects of a catalyst on a reaction. Which trial serves as the experimental control?

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

39 A student spills a diluted acid solution on his hand. He should —

- A wipe it off with a paper towel
- B let it air dry
- C apply a base solution to neutralize it
- D rinse it off with running water

40 The molar volume of an ideal gas in liters at STP is —

- F 6.02×10^{23} L
- G 11.2 L
- H 22.4 L
- J 0.0821 L

41 A tank contains N_2 at 1.0 atm and O_2 at 2.0 atm. Helium is added to this tank until the total pressure is 6.0 atm. What is the partial pressure of the helium?

- A 4.0 atm
- B 3.0 atm
- C 2.0 atm
- D 1.0 atm

42 The type of bond found in magnesium chloride is —

- F covalent
- G nonpolar
- H ionic
- J metallic

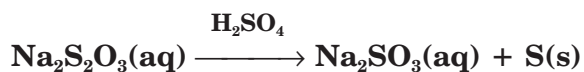
43 Which of these is about 2 moles?

- A 2.0 liters (dm^3) of H_2
- B 4.0 grams of H_2
- C 2.0×10^{23} molecules of H_2
- D 4.0 kilograms of H_2

44 The elements that are characterized by having only five electrons in the p sublevel belong to which family of elements?

- F Transition
- G Alkali
- H Noble gas
- J Halogens

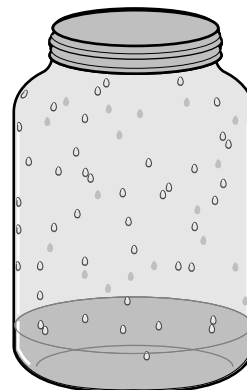
45



In the above reaction, a cloudiness at completion due to colloidal suspension of sulfur appears. If the reaction is carried out at various temperatures, at which temperature would it proceed at the fastest rate?

- A 20°C
- B 30°C
- C 40°C
- D 50°C

46



A heated liquid placed in a closed container will vaporize until —

- F the boundary between liquid and vapor disappears
- G all the liquid molecules become vapor molecules
- H the number of liquid molecules vaporizing equals the number of vapor molecules condensing
- J the vapor pressure is greater than the atmospheric pressure

47 Which of the following liquids would exhibit the highest vapor pressure at 25.0°C?

- A Water, boiling point=100°C
- B Glycerine, boiling point=290°C
- C Ethyl alcohol, boiling point=78.3°C
- D Ether, boiling point=34.6°C

48 To indicate the number of atoms of each element present in a molecular compound, scientists use —

- F Roman numerals
- G superscripts
- H prefixes
- J subscripts

49 The correct name for the compound CCl_4 is —

- A carbon tetrachloride
- B carbon chloride
- C monocarbon chloride
- D tetracarbon monochloride

50 The specific heat capacity of a substance is the quantity of heat required to change the temperature of 1 gram of a substance by —

- F 1°C
- G 5°C
- H 10°C
- J 20°C

Answer Key

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