VIRGINIA
STANDARDS OF LEARNING ASSESSMENTS

Spring 2004 Released Test

END OF COURSE
CHEMISTRY
CORE 1

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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 If a student needed to obtain 8.0 mL of a liquid for an experiment, the appropriate piece of laboratory equipment to use would be a —

A 50 mL beaker
B 1.0 mL pipet
C 50 mL flask
D 10.0 mL graduated cylinder

2 How many grams of sodium chloride are required to prepare 500.0 mL of a 0.100 M solution?

F 1.46 g
G 2.93 g
H 29.3 g
J 58.5 g

3 Which of the following *best* describes why an experiment should be repeated?

A To organize the data
B To produce a variety of results
C To include another variable
D To verify the observed results

4 Which of these is the general formula for a double-replacement reaction?

F $A + B \rightarrow AB$
G $AB + XY \rightarrow BA + YX$
H $AB + XY \rightarrow AY + XB$
J $A + B + XY \rightarrow AX + BY$

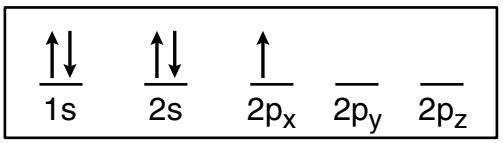
5 The correct formula of an ionic compound containing Al^{3+} and CO_3^{2-} is —

A $AlCO_3$
B $Al(CO_3)_3$
C $Al_2(CO_3)_3$
D $Al_3(CO_3)_2$

GO ON

6 **Which of the following orbital diagrams is *incorrect* because it violates Hund's rule?**

F



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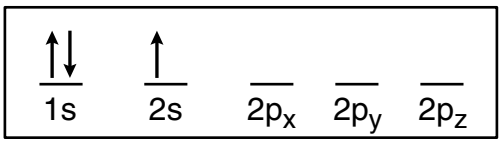

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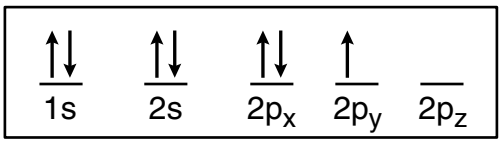

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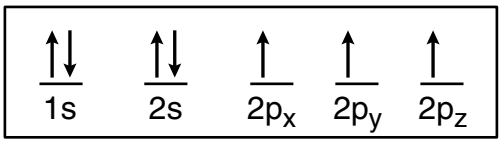
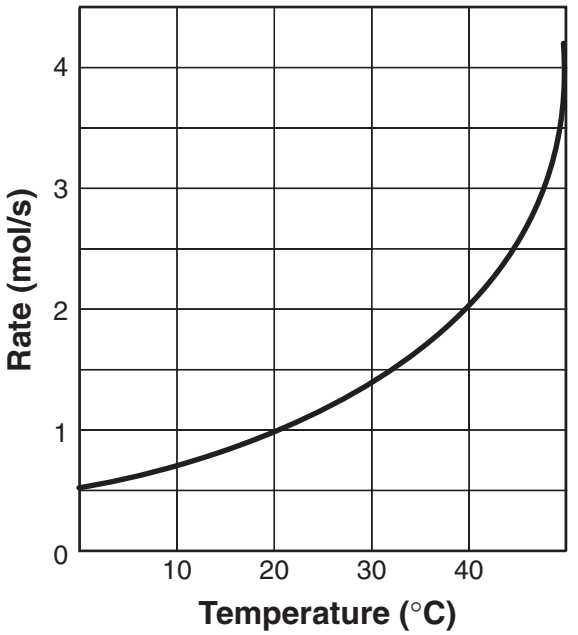


7



The graph shows the rate of a certain reaction as a function of temperature. According to the graph, in order to double the rate of the reaction at 20°C, the temperature must be *increased* by approximately —

A 10°C
B 20°C
C 30°C
D 40°C

8

Aluminum + Sulfuric Acid → Aluminum Sulfate + Hydrogen Gas

Which of the following is the balanced chemical equation for the reaction shown above?

F $Al + H_2SO_4 \rightarrow Al_2(SO_4)_3 + H_2$
G $2Al + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 3H_2$
H $2Al + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + H_2$
J $2Al + H_2SO_4 \rightarrow Al_2(SO_4)_3 + H_2$

GO ON

9

MATERIALS SAFETY DATA SHEET

1.PRODUCT IDENTIFICATION
PRODUCT NAME HYDROCHLORIC ACID
FORMULA HCl
FORMULA WT 36.48
EFFECTIVE 08/07/86
REVISION # 02
PRECAUTIONARY LABELING
BAKER SAF-T-DATA (TM) SYSTEM
HEALTH 3 - SEVERE (POISON)
FLAMMABILITY 0 - NONE
REACTIVITY 2 - MODERATE
CONTACT 3- SEVERE (CORROSIVE)
HAZARD RATINGS ARE 0 TO 4
(0 = NO HAZARD; 4 = EXTREME HAZARD)
LABORATORY PROTECTIVE EQUIPMENT
GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
PRECAUTIONARY LABEL STATEMENTS POISON
DANGER CAUSES SEVERE BURNS MAY BE FATAL IF SWALLOWED OR INHALED
DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
DO NOT BREATHE VAPOR. CAUSES DAMAGE TO RESPIRATORY SYSTEM (LUNGS), EYES AND SKIN.
KEEP IN TIGHTLY CLOSED CONTAINER. LOOSEN CLOSURE CAUTIOUSLY. USE WITH ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF SPILL NEUTRALIZE WITH SODA ASH OR LIME AND PLACE IN DRY CONTAINER.

If a lab group were using hydrochloric acid to perform a substitution reaction, which precaution would *not* be a concern?

A Flammability
B Health
C Reactivity
D Contact

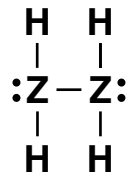
10

$$W + X \rightarrow Y + Z$$

How many grams of product *Z* will be formed if 12.0 g of *W* react with 10.0 g of *X* to form 8.0 g of product *Y* in the reaction shown?

F 8.0 g
G 10.0 g
H 12.0 g
J 14.0 g

11



The figure above shows a compound containing hydrogen (H) and an unknown element Z. To which group on the periodic table does element Z belong?

A 13
B 14
C 15
D 16

GO ON

12 **First measurement: 6.293 g**
Second measurement: 6.294 g
Third measurement: 6.295 g

A student obtained these data after measuring the mass of an object three different times. If the true value of the object's mass is 5.550 g, these data are best described as —

F precise but not accurate
G accurate but not precise
H accurate and precise
J neither accurate nor precise

13 **Which of the following is the name of the molecule PCl_3?**

A Phosphorus trichloride
B Phosphorus chloride
C Potassium trichloride
D Potassium chloride

14 **What is the *main* similarity among elements in group 2?**

F Atomic radius
G Chemical properties
H Mass number
J Boiling point

15

Trial	Mass (g)	Volume (cm^3)	Density (g/cm^3)
1	14.5	2.52	5.75
2	28.3	4.80	5.90
3	33.1	5.75	5.76
4	55.4	9.62	5.76

A team of chemistry students made the above measurements and density calculations of the same type of material. The accepted value (true value) of the density of the material is 5.72 g/cm^3. Which trial has the *least* amount of absolute error?

A 1
B 2
C 3
D 4

16 **The gas with the largest volume at STP is —**

F 10.0 g He
G 10.0 g Ne
H 10.0 g Ar
J 10.0 g Kr

17 **A neutral atom of aluminum-27 contains —**

A 13 protons and 27 electrons
B 14 protons and 13 neutrons
C 13 electrons, 13 protons, and 14 neutrons
D 13 electrons, 14 protons, and 13 neutrons

GO ON

18 Which of the following could cause a gaseous substance to liquify?

F An increase in pressure
G An increase in volume
H An increase in temperature
J A decrease in number of moles

19 The appropriate model for a decomposition reaction is —

A 

B 

C 

D 

20 According to Charles' law, the volume of a fixed amount of gas is directly proportional to —

F isoelectric mixture
G vapor concentration
H barometric pressure
J kelvin temperature

21

Elements	Protons	Neutrons	Electrons
1	11	12	10
2	1	0	2
3	15	16	15
4	20	20	18

Which of the above elements is a positive ion with a charge of one?

A 1
B 2
C 3
D 4

22 The energy required to melt a solid into a liquid is called —

F heat of vaporization
G heat of fusion
H cooling curve
J triple point

23 Cations are formed when neutral atoms lose —

A electrons
B protons
C neutrons
D positrons

GO ON

24 What is represented by the pH of a solution?

F Partial pressure of hydrogen ions in the solution

G Electronegativity of dissociated hydrogen ions in the solution

H Concentration of hydrogen ions in the solution

J Temperature of hydrogen ions in the solution

25 The formula for dinitrogen tetroxide is —

A N_2O_4

B N_3O_3

C N_2O_2

D NO

26 Industrial deep-sea divers must breathe a mixture of helium and oxygen to prevent a disorienting condition known as nitrogen narcosis. If a diver's tank is filled with a helium-oxygen mixture to a pressure of 170 atmospheres and the partial pressure of helium is 110 atmospheres, the partial pressure of the oxygen is —

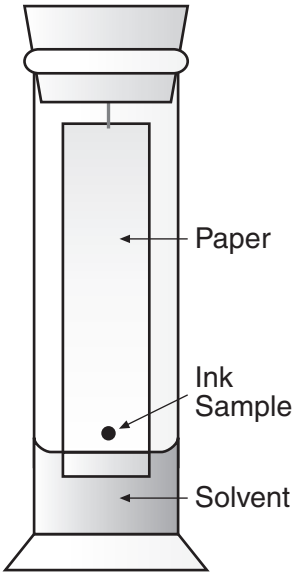
F 60 atm

G 110 atm

H 140 atm

J 280 atm

27



The figure shows an experimental setup used to separate the components of a colored ink sample. Which of the following describes this laboratory technique?

A Chromatography

B Filtration

C Decanting

D Distillation

28 Which of the following properties decreases from left to right across a period?

F Atomic number

G Electronegativity

H Atomic radius

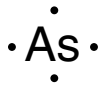
J Ionization energy

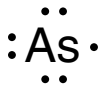
GO ON

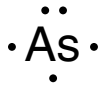
29 A sample of nitrogen occupies 10.0 liters at 25°C and 98.7 kPa. What would be the volume at 20°C and 102.7 kPa?

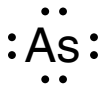
A 7.87 L
B 9.45 L
C 10.2 L
D 10.6 L

30 What is the correct Lewis dot structure for arsenic?

F 

G 

H 

J 

31 The empirical formula for a substance is CH_2. If the molecular mass of the substance is 56, the molecular formula is —

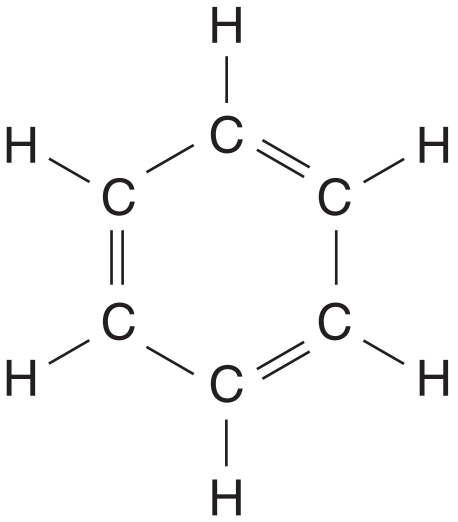
A C_2H_4
B C_3H_6
C C_4H_8
D C_5H_{10}

32 $H_2O(l) \leftrightarrow H_2O(g)$

Water molecules in a sealed jar are in a state of dynamic equilibrium because water vapor molecules —

F are condensing at the same rate that others are evaporating
G cease to form when the air in the jar becomes saturated
H are evaporating faster than they are condensing
J form only at high temperatures

33



The diagram shows the structural formula of benzene. The empirical and the molecular formulas of benzene are, respectively —

A CH, C_2H_2
B CH, C_3H_3
C C_3H_3, C_6H_6
D CH, C_6H_6

GO ON

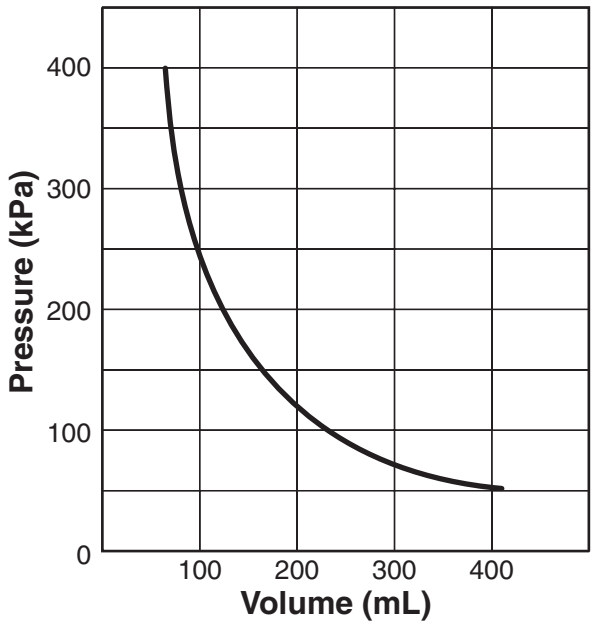
34 How many grams of nitrogen are present in 2 moles of HNO_3?

F 1
G 2
H 14
J 28

35 Which basic lab technique involves the separation of a mixture's components through differences in particle size?

A Filtration
B Extraction
C Distillation
D Crystallization

36



The graph shows the pressure of an ideal gas as a function of its volume. According to the graph, increasing the volume from 100 mL to 150 mL —

F decreases the pressure by 80 kPa
G decreases the pressure by 160 kPa
H increases the pressure by 80 kPa
J increases the pressure by 160 kPa

37

$$Al + HCl \rightarrow AlCl_3 + H_2$$

When the above equation is balanced, the coefficient of the hydrochloric acid will be —

A 2
B 3
C 4
D 6

GO ON

38 Which of the following occurs when a reaction in a solution is at equilibrium and more product is added to the solution?

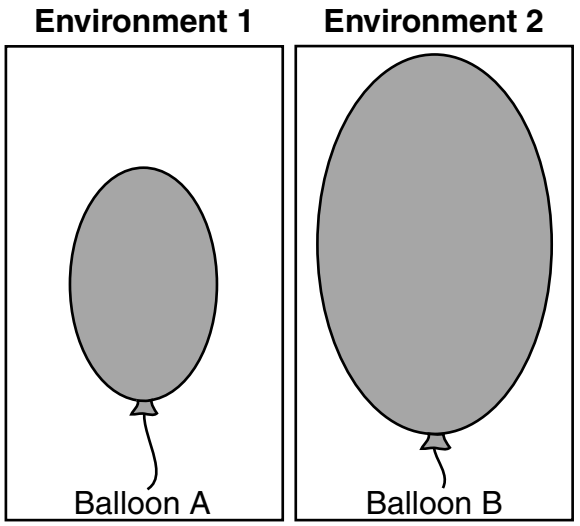
F Equilibrium shifts to produce more product

G Equilibrium shifts to produce more reactant

H No change will occur

J The reaction will stop

39



Each balloon was filled with an identical number of moles of gas. Which of the following *best* explains why balloon B is larger than balloon A?

A The gas in balloon A is under less pressure.

B The gas in balloon A is warmer.

C The gas in balloon B is under more pressure.

D The gas in balloon B is warmer.

40 The atomic number corresponds to an atom's number of —

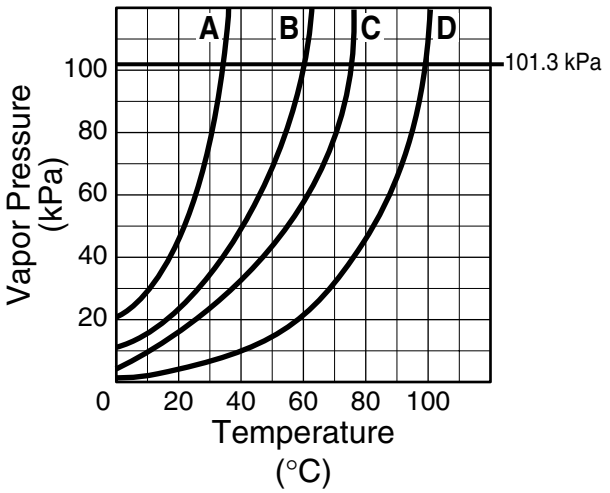
F protons

G neutrons

H electrons

J positrons

41



Line D represents water. If the atmospheric pressure in a flask is lowered to 70 kPa, water would boil at what temperature?

A 32°C

B 70°C

C 92°C

D 100°C

42 How many moles of copper are equivalent to 3.44×10^{23} atoms of copper?

F 0.571 moles

G 1.75 moles

H 5.41×10^{21} moles

J 5.71×10^{22} moles

GO ON

43 Which element naturally occurs as a diatomic molecule?

A Zn
B C
C K
D H

44 What is the molar mass of $Al(NO_3)_3$?

F 57 g/mol
G 103 g/mol
H 165 g/mol
J 213 g/mol

45 What shape does the molecule BF_3 have?

A Bent
B Linear
C Tetrahedral
D Trigonal planar

46 What is the mass in grams of one mole of sulfur dioxide (SO_2)?

F 48.1 g
G 64.1 g
H 80.1 g
J 96.1 g

47

$$Ca(OH)_2 + Al_2(SO_4)_3 \rightarrow CaSO_4 + Al(OH)_3$$

When the above equation is balanced, the coefficients in order are —

A 1, 1, 1, 1
B 2, 1, 1, 2
C 3, 1, 3, 2
D 3, 2, 2, 1

48 Solid magnesium has a specific heat of 1.01 J/g°C. How much heat is given off by a 20.0 gram sample of magnesium when it cools from 70.0°C to 50.0°C?

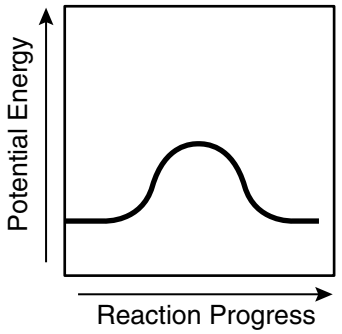
F 202 J
G 404 J
H 808 J
J 1010 J

GO ON

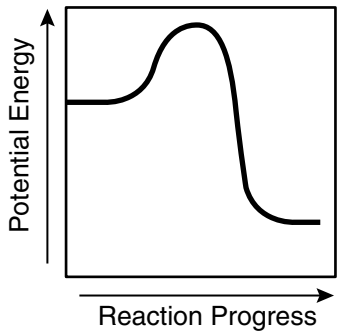
49 $2NO(g) + O_2(g) \rightarrow 2NO_2(g)\ \Delta H = {}^{-}27$ kcal

Which graph represents the reaction shown above?

A



B



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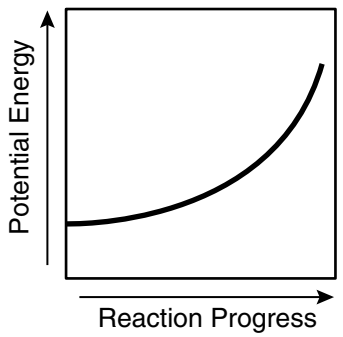
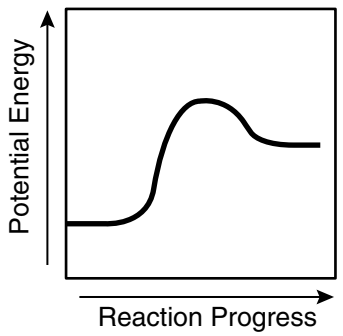


D



50 How should 0.000365 be expressed in proper scientific notation?

F 3.65×10^{4}

G 365

H 3.65

J 3.65×10^{-4}

STOP

Answer Key

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