STAR Test Sample Questions

Chemistry (End-of-course)

Table of Contents

More Questions

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STAR Test Sample Questions

Chemistry (End-of-course)

Conservation of Matter and Stoichiometry (continued)

Proficient Level Questions
- Question 1
- Question 2

Gases and Their Properties

Advanced Level Questions
- Question 1
- Question 2
- Question 3

Proficient Level Questions
- Question 1
- Question 2
- Question 3

Investigation and Experimentation

Advanced Level Questions
- Question 1

Proficient Level Questions
- Question 1
- Question 2
- Question 3
- Question 4

Nuclear Processes

Proficient Level Questions
- Question 1

Basic Level Questions
- Question 1

Organic Chemistry and Biochemistry

Proficient Level Questions
- Question 1
- Question 2
- Question 3

Reaction Rates

Advanced Level Questions
- Question 1

Proficient Level Questions
- Question 1

Solutions

Advanced Level Questions
- Question 1
- Question 2
- Question 3
- Question 4

Proficient Level Questions
- Question 1
- Question 2

Back

Standardized Testing and Reporting - STAR

Chemistry (End-of-course)

Acids and Bases (Performance Level: Advanced) – Question 01

Potassium hydroxide (KOH) is a strong base because it

A easily releases hydroxide ions.

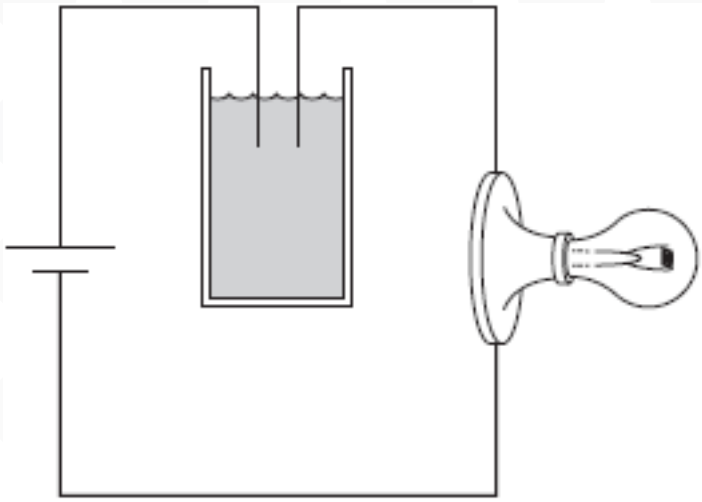
B does not dissolve in water.

C reacts to form salt crystals in water.

D does not conduct an electric current.

Chemistry (End-of-course)

Acids and Bases (Performance Level: Proficient) – Question 01



The above picture shows a light bulb connected to a battery with the circuit interrupted by a solution. When dissolved in the water to form a 1.0 molar solution, all of the following substances will complete a circuit allowing the bulb to light except

A hydrochloric acid.

B sodium nitrate.

C sucrose.

D ammonium sulfate.

Chemistry (End-of-course)

Acids and Bases (Performance Level: Proficient) – Question 02

Equal volumes of 1 molar hydrochloric acid (HCl) and 1 molar sodium hydroxide base (NaOH) are mixed. After mixing, the solution will be

A strongly acidic.

B weakly acidic.

C nearly neutral.

D weakly basic.

Chemistry (End-of-course)

Acids and Bases (Performance Level: Proficient) – Question 03

Which of the following is an observable property of many acids?

A They become slippery when reacting with water.

B They react with metals to release hydrogen gas.

C They produce salts when mixed with other acids.

D They become more acidic when mixed with a base.

Chemistry (End-of-course)

Acids and Bases (Performance Level: Proficient) – Question 04

Of four different laboratory solutions, the solution with the highest acidity has a pH of

A 11.

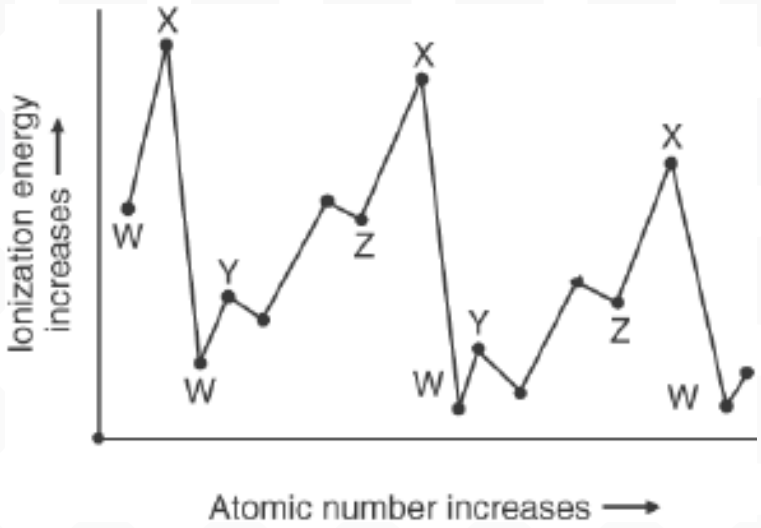
B 7.

C 5.

D 3.

Chemistry (End-of-course)

Atomic and Molecular Structure (Performance Level: Advanced) – Question 01



The chart above shows the relationship between the first ionization energy and the increase in atomic number. The letter on the chart for the alkali family of elements is

A W.

B X.

C Y.

D Z.

Chemistry (End-of-course)

Atomic and Molecular Structure (Performance Level: Advanced) – Question 02

Which statement best describes the density of an atom's nucleus?

A The nucleus occupies most of the atom's volume but contains little of its mass.

B The nucleus occupies very little of the atom's volume and contains little of its mass.

C The nucleus occupies most of the atom's volume and contains most of its mass.

D The nucleus occupies very little of the atom's volume but contains most of its mass.

Chemistry (End-of-course)

Atomic and Molecular Structure (Performance Level: Advanced) – Question 03

What information do the experimental results above reveal about the nucleus of the gold atom?

A The nucleus contains less than half the mass of the atom.

B The nucleus is small and is the densest part of the atom.

C The nucleus contains small positive and negative particles.

D The nucleus is large and occupies most of the atom's space.

Chemistry (End-of-course)

Atomic and Molecular Structure (Performance Level: Proficient) – Question 01

Iodine would have chemical properties most like

A manganese (Mn).

B tellurium (Te).

C chlorine (Cl).

D xenon (Xe).

Chemistry (End-of-course)

Atomic and Molecular Structure (Performance Level: Basic) – Question 01

Which of the following ordered pairs of elements shows an increase in atomic number but a decrease in average atomic mass?

A Ag to Pd

B Co to Ni

C Ge to Sn

D Cr to Mo

Chemistry (End-of-course)

Chemical Bonds (Performance Level: Advanced) – Question 01

When cations and anions join, they form what kind of chemical bond?

A ionic

B hydrogen

C metallic

D covalent

Chemistry (End-of-course)

Chemical Bonds (Performance Level: Advanced) – Question 02

Some of the molecules found in the human body are NH2CH2COOH (glycine), C6H12O6 (glucose), and CH3(CH2)16COOH (stearic acid). The bonds they form are

A nuclear.

B metallic.

C ionic.

D covalent.

Chemistry (End-of-course)

Chemical Bonds (Performance Level: Advanced) – Question 03

Under the same conditions of pressure and temperature, a liquid differs from a gas because the molecules of the liquid

A have no regular arrangement.

B are in constant motion.

C have stronger forces of attraction between them.

D take the shape of the container they are in.

Chemistry (End-of-course)

Chemical Bonds (Performance Level: Proficient) – Question 01

The reason salt crystals, such as KCl, hold together so well is because the cations are strongly attracted to

A neighboring cations.

B the protons in the neighboring nucleus.

C free electrons in the crystals.

D neighboring anions.

Chemistry (End-of-course)

Chemical Equilibrium (Performance Level: Advanced) – Question 01

In which of the following reactions involving gases would the forward reaction be favored by an increase in pressure?

A A + B AB

B A + B C + D

C 2A + B C + 2D

D AC A + C

Chemistry (End-of-course)

Chemical Equilibrium (Performance Level: Advanced) – Question 02

$$4HCl_{(g)} + O_{2(g)} \rightleftarrows 2H_2O_{(l)} + 2Cl_{2(g)} + 113\ kJ$$

Which action will drive the reaction to the right?

A heating the equilibrium mixture

B adding water to the system

C decreasing the oxygen concentration

D increasing the system's pressure

Chemistry (End-of-course)

Chemical Equilibrium (Performance Level: Advanced) – Question 03

$$NO_2(g) + CO(g) \rightleftharpoons NO(g) + CO_2(g)$$

The reaction shown above occurs inside a closed flask. What action will shift the reaction to the left?

A pumping CO gas into the closed flask

B raising the total pressure inside the flask

C increasing the NO concentration in the flask

D venting some CO2 gas from the flask

Chemistry (End-of-course)

Chemical Equilibrium (Performance Level: Advanced) – Question 04

In a sealed bottle that is half full of water, equilibrium will be attained when water molecules

A cease to evaporate.

B begin to condense.

C are equal in number for both the liquid and the gas phase.

D evaporate and condense at equal rates.

Chemistry (End-of-course)

Chemical Thermodynamics (Performance Level: Advanced) – Question 05

The boiling point of liquid nitrogen is 77 kelvin. It is observed that ice forms at the opening of a container of liquid nitrogen. The best explanation for this observation is

A water at zero degrees Celsius is colder than liquid nitrogen and freezes.

B the nitrogen boils and then cools to form a solid at the opening of the container.

C water trapped in the liquid nitrogen escapes and freezes.

D the water vapor in the air over the opening of the liquid nitrogen freezes out.

Chemistry (End-of-course)

Chemical Thermodynamics (Performance Level: Proficient) – Question 01

The random molecular motion of a substance is greatest when the substance is

A condensed.

B a liquid.

C frozen.

D a gas.

Chemistry (End-of-course)

Chemical Thermodynamics (Performance Level: Proficient) – Question 02

The specific heat of copper is about 0.4 joules/ gram °C. How much heat is needed to change the temperature of a 30-gram sample of copper from 20.0 °C to 60.0 °C?

A 1000 J

B 720 J

C 480 J

D 240 J

Chemistry (End-of-course)

Conservation of Matter and Stoichiometry (Performance Level: Advanced) – Question 01

How many moles of carbon-12 are contained in exactly 6 grams of carbon-12?

A 0.5 mole

B 2.0 moles

C 3.01×10^{23} moles

D 6.02×10^{23} moles

Chemistry (End-of-course)

Conservation of Matter and Stoichiometry (Performance Level: Advanced) – Question 02

How many atoms are contained in 97.6 g of platinum (Pt)?

A 5.16×10^{30}

B 3.01×10^{23}

C 1.20×10^{24}

D 1.10×10^{28}

Chemistry (End-of-course)

Conservation of Matter and Stoichiometry (Performance Level: Advanced) – Question 03

When methane (CH4) gas is burned in the presence of oxygen, the following chemical reaction occurs.

$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$$

If 1 mole of methane reacts with 2 moles of oxygen, then

A 6.02×10^{23} molecules of CO2 and 6.02×10^{23} molecules of H2O are produced.

B 1.2×10^{24} molecules of CO2 and 1.2×10^{24} molecules of H2O are produced.

C 6.02×10^{23} molecules of CO2 and 1.2×10^{24} molecules of H2O are produced.

D 1.2×10^{24} molecules of CO2 and 6.02×10^{23} molecules of H2O are produced.

Chemistry (End-of-course)

Conservation of Matter and Stoichiometry (Performance Level: Advanced) – Question 04

How many moles of CH4 are contained in 96.0 grams of CH4?

A 3.00 moles

B 6.00 moles

C 12.0 moles

D 16.0 moles

Chemistry (End-of-course)

Conservation of Matter and Stoichiometry (Performance Level: Advanced) – Question 05

How many atoms are in a chromium sample with a mass of 13 grams?

A 1.5×10^{23}

B 3.3×10^{23}

C 1.20×10^{24}

D 1.10×10^{28}

Chemistry (End-of-course)

Conservation of Matter and Stoichiometry (Performance Level: Advanced) – Question 06

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

In this reaction, how many grams of Fe2O3 are required to completely react with 84 grams of CO?

A 64 g

B 80 g

C 160 g

D 1400 g

Chemistry (End-of-course)

Conservation of Matter and Stoichiometry (Performance Level: Advanced) – Question 07

$$Mg_3N_{2(s)} + 6H_2O_{(l)} \longrightarrow 2NH_{3(aq)} + 3Mg(OH)_{2(s)}$$

If 54.0 grams of water are mixed with excess magnesium nitride, then how many grams of ammonia are produced?

A 1.00

B 17.0

C 51.0

D 153

Chemistry (End-of-course)

Conservation of Matter and Stoichiometry (Performance Level: Proficient) – Question 01

$$C_3H_8 + O_2 \longrightarrow CO_2 + H_2O$$

This chemical equation represents the combustion of propane. When correctly balanced, the coefficient for water is

A 2.

B 4.

C 8.

D 16.

Chemistry (End-of-course)

Conservation of Matter and Stoichiometry (Performance Level: Proficient) – Question 02

Which of the following is a balanced equation for the combustion of ethanol (CH3CH2OH)?

A $CH_3CH_2OH + 3O_2 \longrightarrow CO_2 + 2H_2O$

B $CH_3CH_2OH + 3O_2 \longrightarrow 2CO_2 + 3H_2O$

C $CH_3CH_2OH + O_2 \longrightarrow 2CO_2 + 3HO$

D $CH_3CH_2OH + 2O_2 \longrightarrow 3CO_2 + 2H_2O$

Chemistry (End-of-course)

Gases and Their Properties (Performance Level: Advanced) – Question 01

When someone standing at one end of a large room opens a bottle of vinegar, it may take several minutes for a person at the other end to smell it. Gas molecules at room temperature move at very high velocities, so what is responsible for the delay in detection of the vinegar?

A the increase in the airspace occupied by vinegar molecules

B the chemical reaction with nerves, which is slower than other sensory processes

C attractive forces between the air and vinegar molecules

D random collisions between the air and vinegar molecules

Chemistry (End-of-course)

Gases and Their Properties (Performance Level: Advanced) – Question 02

Methane (CH4) gas diffuses through air because the molecules are

A moving randomly.

B dissolving quickly.

C traveling slowly.

D expanding steadily.

Chemistry (End-of-course)

Gases and Their Properties (Performance Level: Advanced) – Question 03

Under which of the following sets of conditions will a 0.50 mole sample of helium occupy a volume of 11.2 liters?

A 298 K and 0.90 atm

B 273 K and 1.10 atm

C 373 K and 0.50 atm

D 273 K and 1.00 atm

Chemistry (End-of-course)

Gases and Their Properties (Performance Level: Proficient) – Question 01

The volume of 400 mL of chlorine gas at 400 mm Hg is decreased to 200 mL at constant temperature. What is the new gas pressure?

A 400 mm Hg

B 300 mm Hg

C 800 mm Hg

D 650 mm Hg

Chemistry (End-of-course)

Gases and Their Properties (Performance Level: Proficient) – Question 02

Standard temperature and pressure (STP) are defined as

A 0 °C and 1.0 atm pressure.

B 0 °C and 273 mm Hg pressure.

C 0 K and 1.0 atm pressure.

D 0 K and 760 mm Hg pressure.

Chemistry (End-of-course)

Gases and Their Properties (Performance Level: Proficient) – Question 03

What is the equivalent of 423 kelvin in degrees Celsius?

A $-223\ ^{\circ}C$

B $-23\ ^{\circ}C$

C $150\ ^{\circ}C$

D $696\ ^{\circ}C$

Chemistry (End-of-course)

Investigation and Experimentation (Performance Level: Advanced) – Question 01

Matter is made of atoms that have positive centers of neutrons and protons surrounded by a cloud of negatively charged electrons. This statement is

A a theory.

B a hypothesis.

C an inference.

D an observation.

Chemistry (End-of-course)

Investigation and Experimentation (Performance Level: Proficient) – Question 01

A weather balloon with a 2-meter diameter at ambient temperature holds 525 grams of helium. What type of electronic probe could be used to determine the pressure inside the balloon?

A barometric

B thermometric

C calorimetric

D spectrophotometric

Chemistry (End-of-course)

Investigation and Experimentation (Performance Level: Proficient) – Question 02

A scientist observed changes in the gas pressure of one mole of a gas in a sealed chamber with a fixed volume. To identify the source of the changes, the scientist should check for variations in the

A air pressure outside the chamber.

B molecular formula of the gas.

C temperature of the chamber.

D isotopes of the gas.

Chemistry (End-of-course)

Investigation and Experimentation (Performance Level: Proficient) – Question 03

In order to advance to the level of a theory, a hypothesis should be

A obviously accepted by most people.

B a fully functional experiment.

C in alignment with past theories.

D repeatedly confirmed by experimentation.

Chemistry (End-of-course)

Investigation and Experimentation (Performance Level: Proficient) – Question 04

When a metal is heated in a flame, the flame has a distinctive color. This information was eventually extended to the study of stars because

A the color spectra of stars indicate which elements are present.

B a red shift in star color indicates stars are moving away.

C star color indicates absolute distance.

D it allows the observer to determine the size of stars.

Chemistry (End-of-course)

Investigation and Experimentation (Performance Level: Basic) – Question 01

Electrical fires cannot be safely put out by dousing them with water. However, fire extinguishers that spray solid carbon dioxide on the fire work very effectively. This method works because carbon dioxide

A displaces the oxygen.

B renders the fire's fuel non-flammable.

C forms water vapor.

D blows the fire out with strong wind currents.

Chemistry (End-of-course)

Nuclear Processes (Performance Level: Proficient) – Question 01

Why are enormous amounts of energy required to separate a nucleus into its component protons and neutrons even though the protons in the nucleus repel each other?

A The force of the protons repelling each other is small compared to the attraction of the neutrons to each other.

B The electrostatic forces acting between other atoms lowers the force of repulsion of the protons.

C The interactions between neutrons and electrons neutralize the repulsive forces between the protons.

D The forces holding the nucleus together are much stronger than the repulsion between the protons.

Chemistry (End-of-course)

Organic Chemistry and Biochemistry (Performance Level: Proficient) – Question 01

For the polymer, polyvinyl chloride (PVC), ~ CH2CH(Cl)CH2CH(Cl)CH2CH(Cl) ~ the repeating subunit is

A CH(Cl).

B CH(Cl)CHCH2.

C CH2CH.

D CH2CH(Cl).

Chemistry (End-of-course)

Organic Chemistry and Biochemistry (Performance Level: Proficient) – Question 02

Which substance is made up of many monomers joined together in long chains?

A salt.

B protein.

C ethanol.

D propane.

Chemistry (End-of-course)

Organic Chemistry and Biochemistry (Performance Level: Proficient) – Question 03

Proteins are large macromolecules composed of thousands of subunits. The structure of the protein depends on the sequence of

A lipids.

B monosaccharides.

C amino acids.

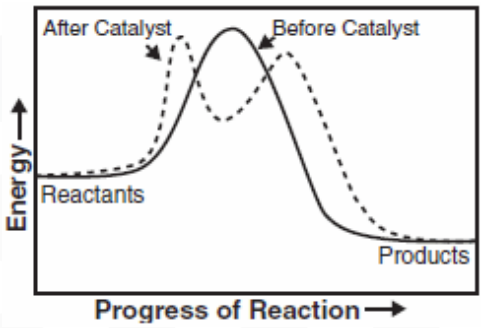
D nucleosides.

Chemistry (End-of-course)

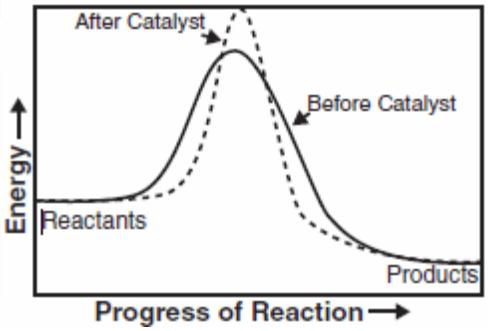
Reaction Rates (Performance Level: Advanced) – Question 01

Which reaction diagram shows the effect of using the appropriate catalyst in a chemical reaction?

A



B



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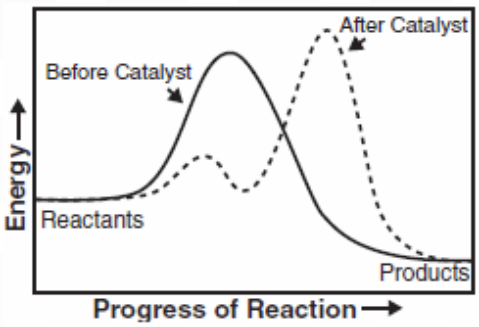

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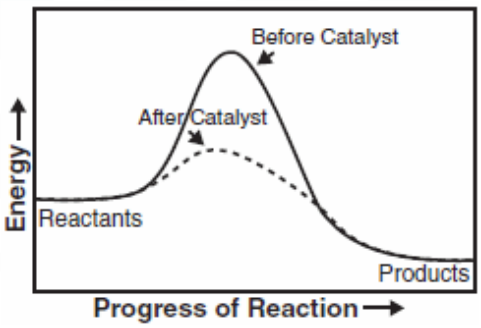

Chemistry (End-of-course)

Reaction Rates (Performance Level: Proficient) – Question 01

H_2O_2, hydrogen peroxide, naturally breaks down into H_2O and O_2 over time. MnO_2, manganese dioxide, can be used to lower the energy of activation needed for this reaction to take place and, thus, increase the rate of reaction. What type of substance is MnO_2?

A a catalyst

B a nenhancer

C a ninhibitor

D a reactant

Chemistry (End-of-course)

Solutions (Performance Level: Advanced) – Question 01

If the attractive forces among solid particles are less than the attractive forces between the solid and a liquid, the solid will

A probably form a new precipitate as its crystal lattice is broken and re-formed.

B be unaffected because attractive forces within the crystal lattice are too strong for the dissolution to occur.

C begin the process of melting to form a liquid.

D dissolve as particles are pulled away from the crystal lattice by the liquid molecules.

Chemistry (End-of-course)

Solutions (Performance Level: Advanced) – Question 02

Water is a polar solvent, while hexane is a nonpolar solvent.

Solute	Water	Hexane
NH_4Cl, ammonium chloride	Soluble	Insoluble
$C_{10}H_8$, naphthalene	Insoluble	Soluble
C_2H_5OH, ethanol	Soluble	Soluble
$CO(NH_2)_2$, urea	Soluble	Insoluble

Which of the examples above illustrates a nonpolar solute in a polar solvent?

A NH4Cl in water

B C10H8 in water

C C2H5OH in hexane

D CO(NH2)2 in hexane

Chemistry (End-of-course)

Solutions (Performance Level: Advanced) – Question 03

The Dead Sea is the saltiest sea in the world. It contains 332 grams of salt per 1000 grams of water. What is the concentration in parts per million (ppm)?

A 0.332 ppm

B 332 ppm

C 33,200 ppm

D 332,000 ppm

Chemistry (End-of-course)

Solutions (Performance Level: Advanced) – Question 04

How many moles of HNO3 are needed to prepare 5.0 liters of a 2.0 M solution of HNO3?

A 2.5

B 5

C 10

D 20

Chemistry (End-of-course)

Solutions (Performance Level: Proficient) – Question 01

Which of the substances in the table can act as either the solute or the solvent when mixed with 100 grams of water at

A NH_3

B C_6H_5COOH

C $MgCl_2$

D CH_3CH_2OH

Chemistry (End-of-course)

Solutions (Performance Level: Proficient) – Question 02

If the solubility of NaCl at 25 °C is 36.2 g/100 g H_2O, what mass of NaCl can be dissolved in 50.0 g of H_2O?

A 18.1 g

B 36.2 g

C 72.4 g

D 86.2 g