

Question Source:

WEST (Washington) General Science Sample Test

The type of chemical bond that an element will form with another element is most directly related to:

- A. the difference between the total number of protons in the two elements.
- B. the total number of electron energy levels in each of the two different elements.
- C. the difference between the total number of neutrons and electrons in each element.
- D. the number of electrons in the highest energy levels of the two elements.

Correct Response: D

Question Source:

WEST (Washington) General Science Sample Test

A chemist is studying a compound that forms when one atom loses an electron and another atom gains the lost electron. Which of the following types of chemical bond is formed?

- A. a covalent bond
- B. an ionic bond
- C. a metallic bond
- D. a hydrogen bond

Correct Response: B

Question Source:

WEST (Washington) General Science Sample Test

In the 1930s scientists demonstrated that mass could be converted into energy by bombarding a particular element with neutrons. Aside from energy, which of the following describes the products of this nuclear fission process?

- A. lighter elements and neutrons
- B. a chemical compound and subatomic particles
- C. heavier elements and protons
- D. a radioactive compound and electrons

Correct Response: A

Question Source:

WEST (Washington) General Science Sample Test

A scientist adds 1 mol of salt to 1 kg of water to raise the water's boiling point. The scientist then tries adding 1 mol of sugar to 1 kg of water, but discovers that it does not raise the boiling point as much as the salt does. Which of the following explains why salt raises the boiling point of water more than sugar does?

- A. Dissolution of the sugar molecules increases the density of the water.
- B. Sugar reduces the surface tension of the water.
- C. Ionization of the salt creates twice as many particles in the water.
- D. Salt reduces the vapor pressure of the water.

Correct Response: C

Question Source:

WEST (Washington) General Science Sample Test

A chemist determines that the hydrogen ion concentration $[H^+]$ of a solution is $3.2 \times 10^{-9} M$. Given that $pH = -\log [H^+]$, what is the approximate pH of the solution?

- A. 8.5
- B. 9.0
- C. 9.3
- D. 9.5

Correct Response: A

Question Source:

WEST (Washington) General Science Sample Test

The air pressure exerted on the outside of a balloon inflated to a volume of 1.0 L at the earth's surface is 100 kPa. If the balloon is brought to an elevation where the pressure exerted on the balloon is 80 kPa and the temperature is the same, what will the volume of the balloon be?

- A. 0.25 L
- B. 0.8 L
- C. 1.25 L
- D. 1.8 L

Correct Response: C

Question Source:

WEST (Washington) General Science Sample Test

Which of the following physical phenomena is primarily responsible for the chill that a person often experiences immediately after bathing?

- A. evaporation
- B. convection
- C. condensation
- D. diffusion

Correct Response: A

Question Source:

WEST (Washington) Chemistry Sample Test

A chemist has determined that an unknown sample has a high melting point, is ductile, and forms hydrogen gas and a salt when reacted with HCl acid. Based on these findings, the unknown sample is also likely to:

- A. have a high electronegativity value.
- B. be brittle at room temperature.
- C. have a dull appearance.
- D. be a good conductor of electricity.

Correct Response: D

Question Source:

WEST (Washington) Chemistry Sample Test

In which of the following sets of elements are the elements arranged in order of increasing atomic radius?

- A. Po, Sb, Ge
- B. Li, Na, K
- C. Si, P, S
- D. Br, Cl, F

Correct Response: B

Question Source:

WEST (Washington) Chemistry Sample Test

Rutherford's gold foil experiment provided evidence that led to which of the following conclusions about atomic structure?

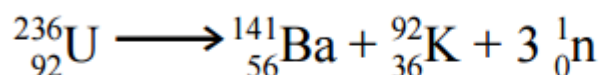
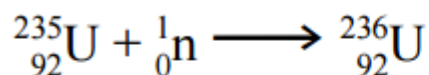
- A. Electrons exist only in certain discrete energy levels.
- B. Atoms contain small densely packed nuclei.
- C. The exact location of an electron at any given time cannot be determined.
- D. Atoms display the properties of both particles and waves.

Correct Response: B

Question Source:

WEST (Washington) Chemistry Sample Test

Use the reactions below to answer the question that follows.



The reactions described in the equations above are used in which of the following applications?

- A. the medical treatment of cancer
- B. the dating of archaeological artifacts
- C. the production of electricity
- D. the irradiation of food products

Correct Response: C

Question Source:

WEST (Washington) Chemistry Sample Test

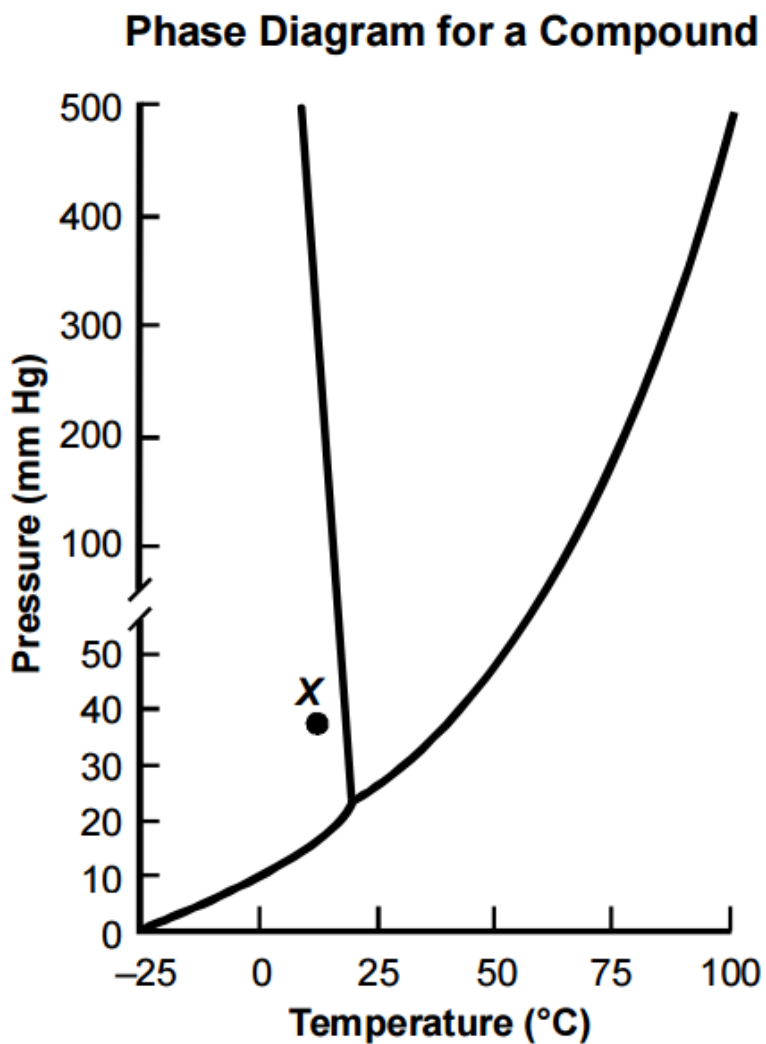
Ethanol has a specific heat of $2.45 \text{ J/g}\cdot\text{K}$ and a density of 0.7893 g/cm^3 . How much heat is required to raise the temperature of 100.0 mL of ethanol from 5.0°C to 20.0°C ?

- A. 2.90 kJ
- B. 3.68 kJ
- C. 55.7 kJ
- D. 70.6 kJ

Correct Response: A

Question Source:

WEST (Washington) Chemistry Sample Test



Which of the following changes will lead to the sublimation of the sample at point *X* on the phase diagram above?

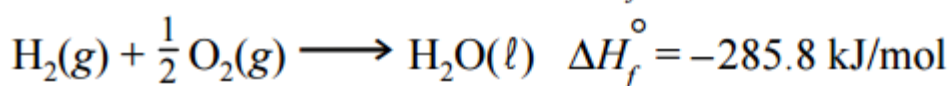
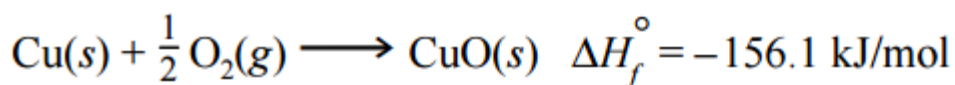
- A. increasing the pressure to 500 mm Hg
- B. decreasing the temperature to -5.0°C
- C. increasing the temperature to 100.0°C
- D. decreasing the pressure to 5 mm Hg

Correct Response: D

Question Source:

WEST (Washington) Chemistry Sample Test

Use the information below to answer the question that follows.



Given the balanced equations and standard molar enthalpies of formation shown above, what will be the standard enthalpy change (ΔH_{rxn}°) for the reaction between copper oxide and hydrogen?

- A. −259.4 kJ
- B. −441.9 kJ
- C. −883.8 kJ
- D. −1320 kJ

Correct Response: A

Question Source:

WEST (Washington) Chemistry Sample Test

Use the table below to answer the question that follows.

Molecule	Molecular Geometry	Molecular Polarity
CH ₄	trigonal pyramidal	polar
CO ₂	linear	nonpolar
NH ₃	tetrahedral	polar
H ₂ O	bent	nonpolar

In the table above, which molecule is matched with its correct molecular geometry and molecular polarity?

- A. CH₄
- B. CO₂
- C. NH₃
- D. H₂O

Correct Response: B

Question Source:

WEST (Washington) Chemistry Sample Test

Use the table below to answer the question that follows.

Line	Chemical Formula	IUPAC Name
1	Fe_2O_3	iron(II) trioxide
2	CH_3CO_2^-	methylcarbonate ion
3	$\text{CH}_3\text{CH}_2\text{CH}_3$	propane
4	PCl_5	phosphorus chloride

Which line in the table above correctly matches a chemical formula with its IUPAC name?

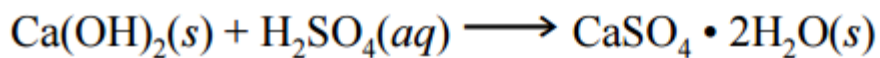
- A. Line 1
- B. Line 2
- C. Line 3
- D. Line 4

Correct Response: C

Question Source:

WEST (Washington) Chemistry Sample Test

Use the equation below to answer the question that follows.



The equation above describes a process commonly used by coal-fueled power plants to remove sulfur oxides present in exhaust gases. This is an example of which of the following types of chemical reactions?

- A. combustion
- B. single replacement
- C. neutralization
- D. decomposition

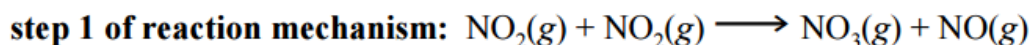
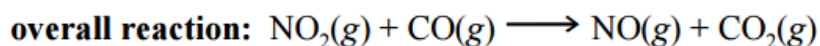
Correct Response: C

Question Source:

WEST (Washington) Chemistry Sample Test

Use the information below to answer the question that follows.

Reaction of Nitrogen Dioxide and Carbon Monoxide



At low temperatures, the reaction between nitrogen dioxide and carbon monoxide occurs in two steps. Given the information shown above, which of the following reactions is step 2 of the reaction mechanism?

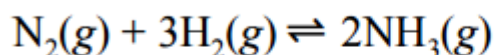
- A. $\text{NO}_3(g) + \text{NO}(g) \longrightarrow \text{N}_2\text{O}_4(g)$
- B. $\text{NO}_3(g) + \text{CO}(g) \longrightarrow \text{NO}_2(g) + \text{CO}_2(g)$
- C. $\text{NO}(g) + \text{NO}_2(g) \longrightarrow 2\text{NO}(g)$
- D. $\text{NO}(g) + \text{CO}(g) \longrightarrow \text{N}(g) + \text{CO}_2(g)$

Correct Response: B

Question Source:

WEST (Washington) Chemistry Sample Test

Use the reaction below to answer the question that follows.



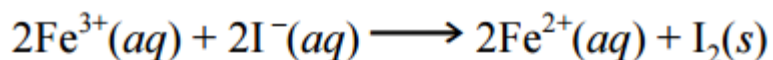
The Haber-Bosch process used in the commercial synthesis of ammonia from nitrogen and hydrogen is shown above. The process includes a condensation step in which the ammonia gas produced is condensed into a liquid. Which of the following best describes the role this condensation step plays in the process?

- A. Reducing the concentration of ammonia gas shifts the equilibrium to the right, driving the formation of more product.
- B. Removing ammonia gas from the system lowers the activation energy of the synthesis reaction.
- C. Condensing the ammonia gas into its liquid state removes contaminants that may have been introduced into the system.
- D. Converting ammonia gas to a liquid increases the equilibrium constant, leading to a greater yield of product.

Correct Response: A

Question Source:

WEST (Washington) Chemistry Sample Test



Standard Reduction Potentials (at 25°C)	
Half-reaction	$E^{\circ}(\text{V})$
$\text{Fe}^{3+}(\text{aq}) + \text{e}^{-} \longrightarrow \text{Fe}^{2+}(\text{aq})$	0.769
$\text{I}_2(\text{s}) + 2\text{e}^{-} \longrightarrow 2\text{I}^{-}(\text{aq})$	0.534

The net ionic equation for the reaction between iron(III) ions and iodide ions and the standard reduction potentials for the related half-reactions are shown above. Given the value for the Faraday constant of $F = 9.648 \times 10^4 \text{ J/mol}\cdot\text{V}$, what will be the standard free-energy change (ΔG°) for this reaction at 25°C?

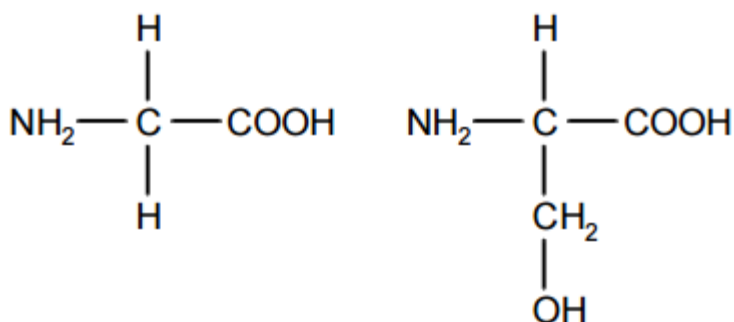
- A. -22.7 kJ
- B. -45.3 kJ
- C. -90.6 kJ
- D. -251 kJ

Correct Response: B

Question Source:

WEST (Washington) Chemistry Sample Test

Use the diagrams below to answer the question that follows.



The two amino acids shown above can be joined together using which of the following chemical reactions?

- A. esterification
- B. substitution
- C. combustion
- D. condensation

Correct Response: D

Question Source:

WEST (Washington) Chemistry Sample Test

Use the table below to answer the question that follows.

Ascorbic Acid (molar mass = 176.1 g/mol)	
Percent by Mass of Component Elements	Component Elements of Ascorbic Acid
54.5	oxygen
40.9	carbon
4.6	hydrogen

The table above gives the molar mass of ascorbic acid and the percent by mass of its component elements. Given this information, what is the molecular formula for ascorbic acid?

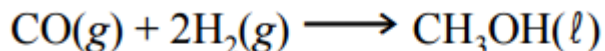
- A. $\text{C}_3\text{H}_4\text{O}_3$
- B. $\text{C}_6\text{H}_6\text{O}_6$
- C. $\text{C}_9\text{H}_{12}\text{O}_9$
- D. $\text{C}_6\text{H}_8\text{O}_6$

Correct Response: D

Question Source:

WEST (Washington) Chemistry Sample Test

Use the reaction below to answer the question that follows.



534 g CO and 98.0 g H₂ are combined to form methanol according to the reaction above. What mass of the excess reactant remains after all of the limiting reactant has been consumed?

- A. 21.2 g
- B. 59.7 g
- C. 98.2 g
- D. 338 g

Correct Response: A

Question Source:

WEST (Washington) Chemistry Sample Test

Scuba divers that surface too quickly after spending time at depths greater than 15 m need to take precautions during their ascent to prevent the formation of nitrogen gas bubbles in the bloodstream. This problem experienced by divers is most similar to which of the following physical phenomena?

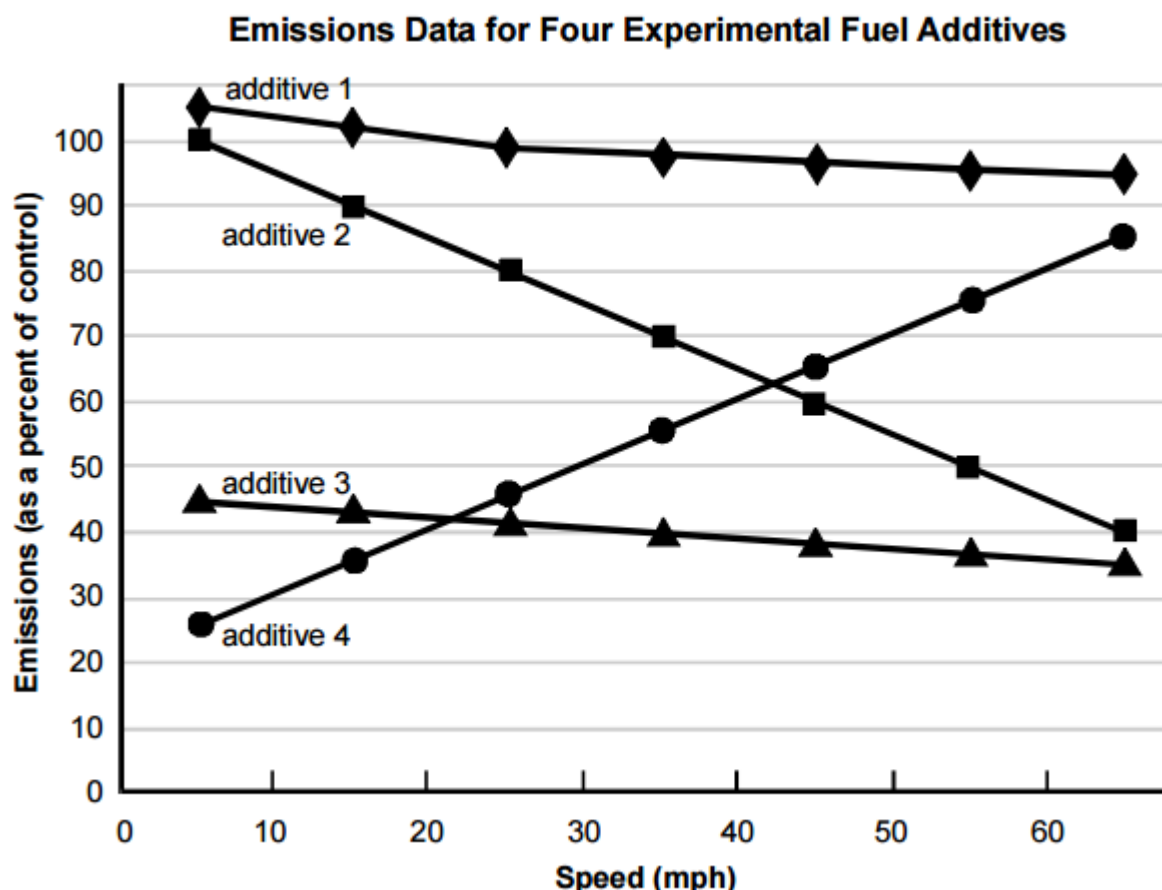
- A. The boiling point of water is increased by dissolving table salt in the water.
- B. The air molecules in a balloon expand the volume of the balloon as it rises into the atmosphere, where atmospheric pressure is lower.
- C. The adiabatic warming of an air mass occurs as the air is compressed.
- D. The dissolved carbon dioxide in soda comes out of solution when the pressure is decreased as the bottle is opened.

Correct Response: D

Question Source:

WEST (Washington) Chemistry Sample Test

Use the chart below to answer the question that follows.



A research chemist has synthesized four fuel additives designed to reduce auto emissions. The experimental fuel additives were added to commercial gasoline and emissions data were collected for speeds ranging from 5 mph to 65 mph. The collected data were graphed in the above chart to show the effectiveness of each additive at different speeds. Which of the following conclusions is best supported by the results shown in the chart?

- A. Additive 1 demonstrates the greatest increase in fuel efficiency over the widest range of driving speeds.
- B. Additives 2 and 4 have the same effect on emissions if all driving speeds are considered.
- C. Additive 4 is most effective at reducing emissions at speeds greater than 50 mph.
- D. Additive 3 produces the greatest average reduction in emissions when all driving speeds are considered.

Correct Response: D

Question Source:

WEST (Washington) Chemistry Sample Test

Read the newspaper article below; then answer the question that follows.

New Energy Source Could End Country's Reliance on Fossil Fuels

By providing abundant and clean energy, a newly discovered fusion process promises to dramatically reduce the country's reliance on fossil fuels. Researchers at a leading university announced that they have succeeded in producing abundant energy through a relatively inexpensive fusion process. With the world's reliance on fossil fuels implicated as a major cause of global warming, many people have proclaimed the discovery as one of the most important of our time. The researchers who worked on the project said that many existing power plants could be retrofitted with the new technology, reducing both the environmental and political problems associated with the country's dependence on fossil fuels.

The newspaper article shown above describes the discovery of a new process for producing energy. In evaluating whether the researchers' claims about this fusion process are valid, which of the following questions is it most important to consider?

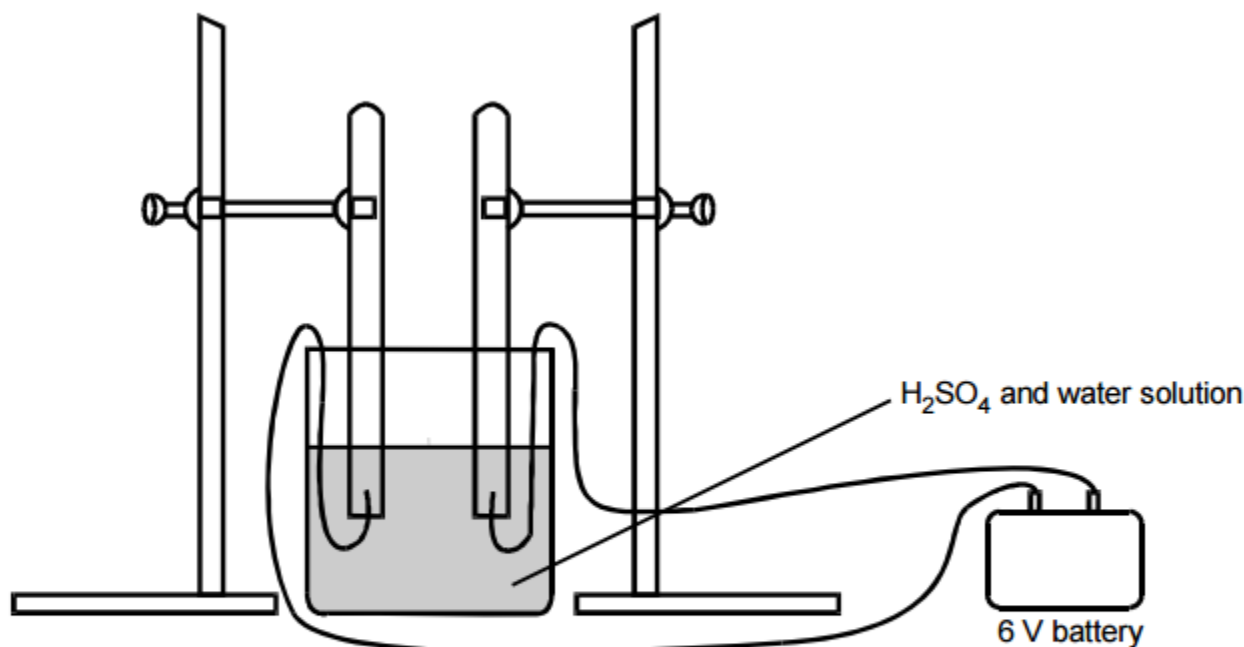
- A. Have the researchers released information on the source of funds used to develop the process?
- B. Will the process announced by the researchers provide affordable energy to the average consumer?
- C. Have the researchers' claims about the process been evaluated by scientists not connected to the project?
- D. Will the raw materials required to carry out the process be available to underdeveloped countries?

Correct Response: C

Question Source:

WEST (Washington) Chemistry Sample Test

Use the diagram below to answer the question that follows.



A scientist plans to set up and use the apparatus shown in the diagram above to decompose water by electrolysis. Which of the following aspects of setting up and using this apparatus represents the most serious safety hazard?

- A. the removal of insulation from the ends of the wires
- B. the addition of sulfuric acid to the water in the beaker
- C. the connection of the wires to the terminals of the 6 V battery
- D. the displacement of water within the inverted test tubes

Correct Response: B

Question Source:

WEST (Washington) Middle Level Science Sample Test

Which of the following best describes a common characteristic of most ionic compounds?

- A. They have very low melting points.
- B. They are good electrical conductors in the solid state.
- C. They are insoluble in water.
- D. They have a brittle, crystalline structure at room temperature.

Correct Response: D

Question Source:

WEST (Washington) Middle Level Science Sample Test

How many grams of potassium chloride (KCl) should be dissolved in 250 mL of water to prepare a 3 *M* solution of KCl?

- A. 18.64 g
- B. 29.33 g
- C. 55.91 g
- D. 223.65 g

Correct Response: C

Question Source:

WEST (Washington) Middle Level Science Sample Test

A biologist determines that a solution has a pH of 8.0. This result indicates that the solution is:

- A. acidic.
- B. neutral.
- C. basic.
- D. buffered.

Correct Response: C

Question Source:

WEST (Washington) Middle Level Science Sample Test

Use the table below to answer the question that follows.

	Measured Mass (g)			
Student	Trial 1	Trial 2	Trial 3	Mean
A	0.425	0.475	0.498	0.466
B	0.656	0.657	0.655	0.656
C	0.511	0.489	0.501	0.500
D	0.576	0.503	0.495	0.525

Four chemistry students have performed an experiment designed to produce 0.500 g of product. The students have determined the mean mass of product produced in their individual experiments and recorded the results shown in the table above. Which student's result is the most precise?

- A. student A
- B. student B
- C. student C
- D. student D

Correct Response: B