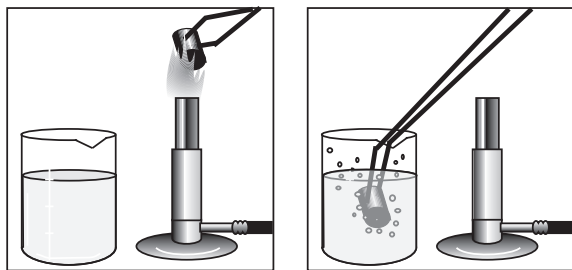


1. Consider the spectrum for the hydrogen atom. In which situation will light be produced?
- A Electrons absorb energy as they move to an excited state.
 - B Electrons release energy as they move to an excited state.
 - C Electrons absorb energy as they return to the ground state.
 - D Electrons release energy as they return to the ground state.
2. Which statement regarding red and green visible light is correct?
- A The speed of green light is greater than that of red light.
 - B The wavelength of green light is longer than that of red light.
 - C The energy of green light is lower than that of red light.
 - D The frequency of green light is higher than that of red light.
3. Which color of light would a hydrogen atom emit when an electron changes from the $n = 5$ level to the $n = 2$ level?
- A red
 - B yellow
 - C green
 - D blue
4. What energy level transition is indicated when the light emitted by a hydrogen atom has a wavelength of 103 nm?
- A $n = 2$ to $n = 1$
 - B $n = 3$ to $n = 1$
 - C $n = 4$ to $n = 2$
 - D $n = 5$ to $n = 2$

5. A piece of metal is heated in a Bunsen burner flame and then immersed in a beaker of cool water.



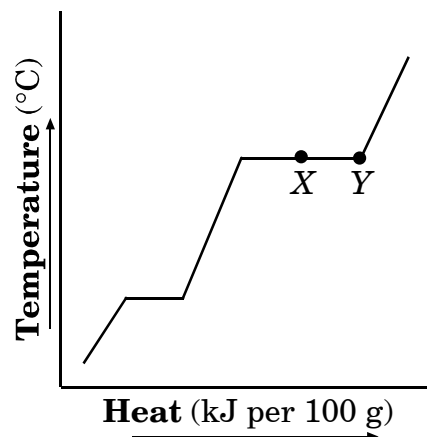
Which statement *best* describes the effect of the temperature changes on the kinetic energy of the particles?

- A Kinetic energy of metal atoms decreases in the flame.
- B Kinetic energy of water molecules increases when the heated metal is immersed.
- C Kinetic energy of water molecules decreases when the heated metal is immersed.
- D Kinetic energy of metal atoms increases when immersed in the cooler water.

6. The gases helium, neon, and argon are in separate containers at 55°C . Which is true about the kinetic energy of the gases?

- A Helium has the lowest mass and therefore greatest kinetic energy.
- B They each have a different kinetic energy.
- C Argon has the greatest mass and therefore the greatest kinetic energy.
- D They all have the same average kinetic energy.

7. This is a heating curve for a substance.



Between points X and Y, which would be observed?

- A Solid and liquid will be present.
- B Only vapor will be present.
- C Liquid and vapor will be present.
- D Only liquid will be present.

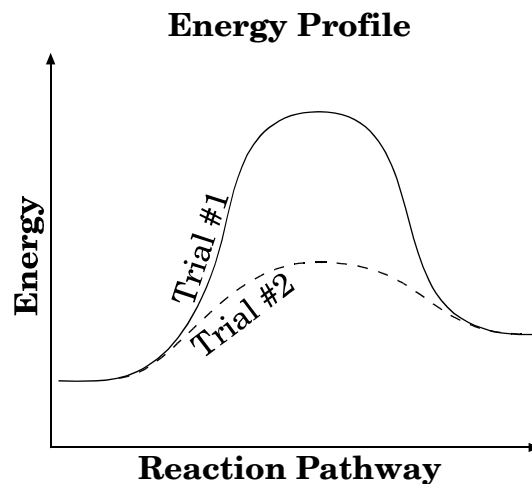
8. An open container of water is brought to a boil and heated until all of the water is converted to water vapor. Which describes the changes in the water molecules?
- A The molecules speed up and move farther apart.
- B The molecules speed up and move closer together.
- C The molecules slow down and move farther apart.
- D The molecules slow down and move closer together.
9. 6.00 g of gold was heated from 20.0°C to 22.0°C. How much heat was applied to the gold?
- A 1.55 J
- B 15.5 J
- C 17.0 J
- D 32.5 J
10. A student has a beaker containing 55 g of water at 100°C. How much heat is needed to convert the water to steam?
- A 120,000 J
- B 18,000 J
- C 2,200 J
- D 330 J
11. How many grams of ice will melt at 0°C if the ice absorbs 420. J of energy?
- A 0.186 g
- B 0.795 g
- C 1.26 g
- D 5.38×10^4 g
12. An 18.0-g piece of an unidentified metal was heated from 21.5°C to 89.0°C. If 292 J of heat energy was absorbed by the metal in the heating process, what was the identity of the metal?

Specific Heat Table

Substance	Specific Heat
Aluminum	0.90 J/g•°C
Calcium	0.65 J/g•°C
Copper	0.39 J/g•°C
Gold	0.13 J/g•°C
Iron	0.46 J/g•°C
Mercury	0.14 J/g•°C
Silver	0.24 J/g•°C

- A calcium
- B copper
- C iron
- D silver

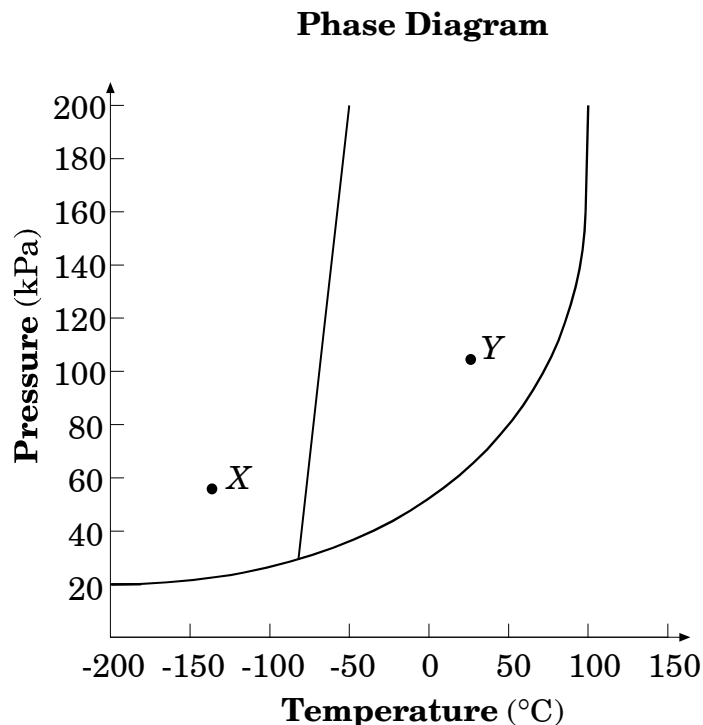
13. This graph represents the change in energy for two laboratory trials of the same reaction.



Which factor could explain the energy difference between the trials?

- A Heat was added to trial #2.
- B A catalyst was added to trial #2.
- C Trial #1 was stirred.
- D Trial #1 was cooled.

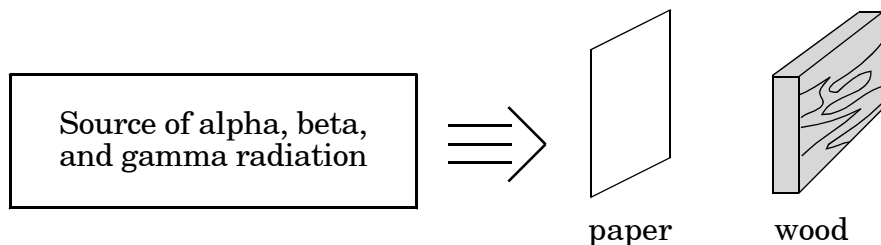
14. Consider this phase diagram.



What process is occurring when a substance changes from point X (-130°C and 50 kPa) to point Y (30°C and 100 kPa)?

- A boiling
 - B freezing
 - C melting
 - D sublimation
-
15. When a chemical cold pack is activated, it becomes cool to the touch. What is happening in terms of energy?
- A An exothermic reaction is occurring, absorbing cold from its surroundings.
 - B An exothermic reaction is occurring, releasing heat to its surroundings.
 - C An endothermic reaction is occurring, releasing cold to its surroundings.
 - D An endothermic reaction is occurring, absorbing heat from its surroundings.

16. Consider this diagram:



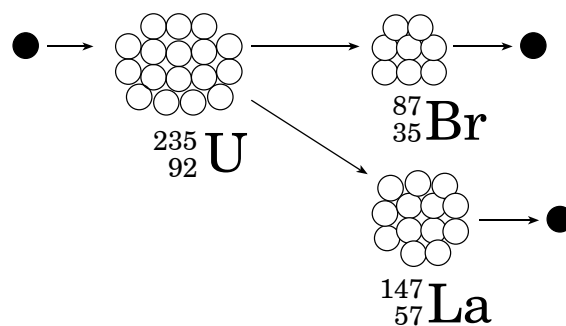
Which of the three types of radiation will penetrate the paper and wood?

- A alpha, beta, gamma
- B alpha and beta only
- C gamma only
- D beta only

17. The half-life of phosphorus-32 is 14.30 days. How many milligrams of a 20.00 mg sample of phosphorus-32 will remain after 85.80 days?

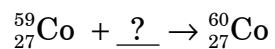
- A 3.333 mg
- B 0.6250 mg
- C 0.3125 mg
- D 0.1563 mg

18. In the figure below, what type of nuclear activity is represented?



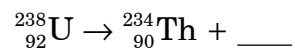
- A fission
- B fusion
- C alpha emission
- D beta emission

19. Which particle will complete this reaction?



- A electron
- B neutron
- C nucleus
- D proton

20. Which will complete this equation?



- A ${}_{-1}^0e$
- B ${}_{0}^0\gamma$
- C ${}_{1}^1\text{H}$
- D ${}_{2}^4\text{He}$

End of Goal 4 Sample Items

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Chemistry Goal 4

Sample Items Key Report

- 7 Objective: 4.02**
Analyze the law of conservation of energy, energy transformation, and various forms of energy involved in chemical and physical processes.
A. Differentiate between heat and
b. Analyze heating and cooling
c. Calorimetry, heat of fusion and heat of vaporization
d. Endothermic and exothermic processes including interpretation of potential energy. Diagrams (energy vs. reaction pathway), enthalpy and activation energy.
Thinking Skill: Analyzing **Correct Answer:** C
- 8 Objective: 4.02**
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Thinking Skill: Applying **Correct Answer:** A
- 9 Objective: 4.02**
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Thinking Skill: Applying **Correct Answer:** A
- 10 Objective: 4.02**
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Thinking Skill: Applying **Correct Answer:** A
- 11 Objective: 4.02**
Analyze the law of conservation of energy, energy transformation, and various forms of energy involved in chemical and physical processes.
A. Differentiate between heat and
-

Chemistry Goal 4

Sample Items Key Report

b. Analyze heating and cooling
c. Calorimetry, heat of fusion and heat of vaporization
d. Endothermic and exothermic processes including interpretation of potential energy. Diagrams (energy vs. reaction pathway), enthalpy and activation energy.
Thinking Skill: Applying **Correct Answer:** C

12 Objective: 4.02
Analyze the law of conservation of energy, energy transformation, and various forms of energy involved in chemical and physical processes.
A. Differentiate between heat and
b. Analyze heating and cooling
c. Calorimetry, heat of fusion and heat of vaporization
d. Endothermic and exothermic processes including interpretation of potential energy. Diagrams (energy vs. reaction pathway), enthalpy and activation energy.
Thinking Skill: Analyzing **Correct Answer:** D

13 Objective: 4.03
Assess reaction rates and factors that affect reaction rates.
Thinking Skill: Applying **Correct Answer:** B

14 Objective: 4.01
Analyze the Bohr model in terms of electron energies in the hydrogen atom.
a. The spectrum of electromagnetic
b. Emission and absorption of electromagnetic energy as electrons change energy levels.
Thinking Skill: Analyzing **Correct Answer:** C

15 Objective: 4.02
Analyze the law of conservation of energy, energy transformation, and various forms of energy involved in chemical and physical processes.
A. Differentiate between heat and
b. Analyze heating and cooling
c. Calorimetry, heat of fusion and heat of vaporization
d. Endothermic and exothermic processes including interpretation of potential energy. Diagrams (energy vs. reaction pathway), enthalpy and activation energy.
Thinking Skill: Knowledge **Correct Answer:** D

16 Objective: 4.04
Analyze nuclear energy.
A. Radioactivity: characteristics of alpha, beta and gamma
b. Decay equations for alpha and beta
c. Half-life and fission and
d. Fission and fusion.
Thinking Skill: Analyzing **Correct Answer:** C

