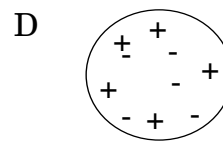
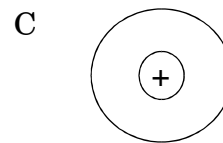
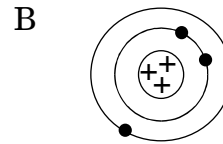
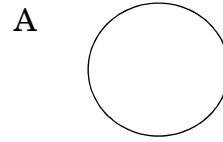


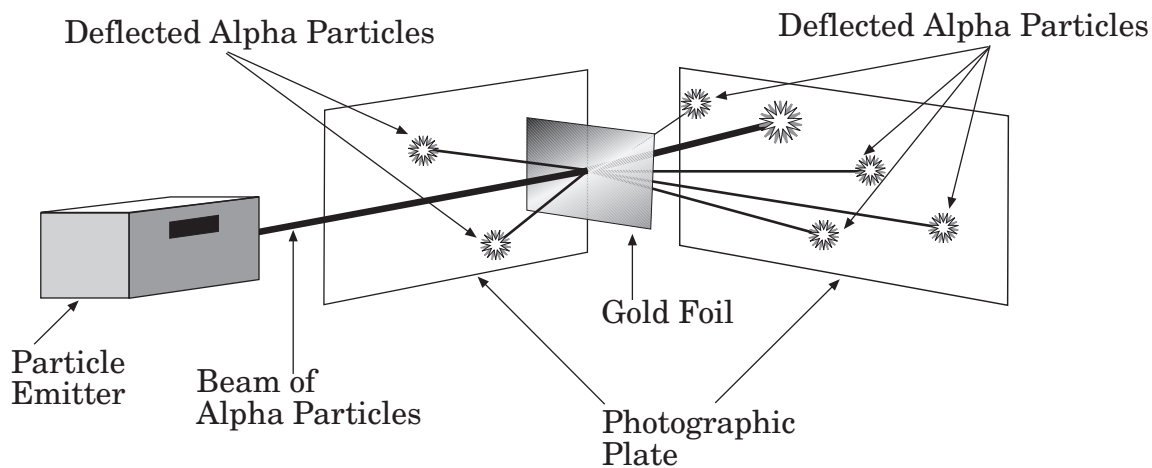
1. Which part of Dalton's atomic theory was disproved by further scientific research?
- A All elements are composed of atoms.
  - B Atoms are indivisible particles.
  - C Atoms of different elements are different.
  - D Compounds are composed of two or more elements.

2. Which model **best** illustrates Thomson's explanation of the atom?



3. Ernest Rutherford performed a famous experiment in which he used a radioactive alpha particle source and aimed the particles at a thin sheet of gold foil. By studying photographic plates placed around the foil, he found that most particles passed straight through, some were deflected, and some reflected straight back. This discovery led him to make several important conclusions.

### Rutherford's Experiment



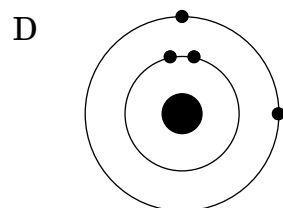
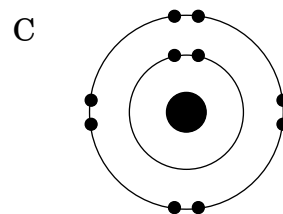
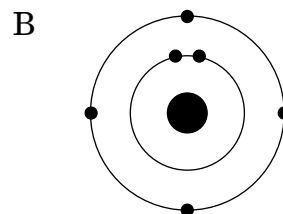
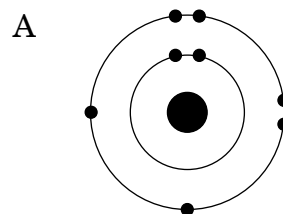
Using the experimental setup, what conclusions about atoms were made by Rutherford?

- A An atom is mostly empty space, with a small, dense, positively-charged center.
- B Atoms are solid, dense, neutrally-charged particles.
- C Atoms are empty space except for randomly scattered negative particles.
- D An atom is mostly composed of a large, positively-charged energy cloud.

4. What was Niels Bohr's prediction about the location of the electrons in an atom?
- A Electrons pair with protons and stay in the nucleus of the atoms.
  - B Electrons can be found at various levels within an energy cloud surrounding the nucleus.
  - C Electrons orbit the nucleus in well-defined energy levels or orbitals.
  - D Electrons are scattered randomly in a positive background matrix.

5. Which **best** describes the current model of an atom?
- A a solid sphere with electrons and protons embedded
  - B a solid sphere unique for everything that exists
  - C a central nucleus containing protons and neutrons with electrons orbiting in levels of high probability
  - D a central nucleus containing protons with electrons orbiting in specific paths

6. An atom with which atomic diagram has chemical properties **most similar** to calcium?



7. Which distinguishes an atom of one element from an atom of a different element?
- A the number of protons
  - B the number of neutrons
  - C the number of electrons
  - D the number of neutrons and protons

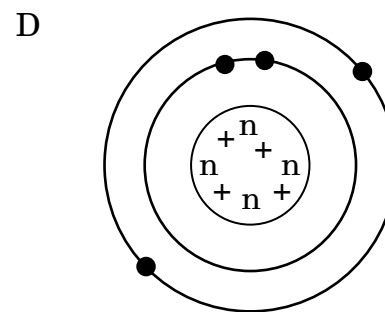
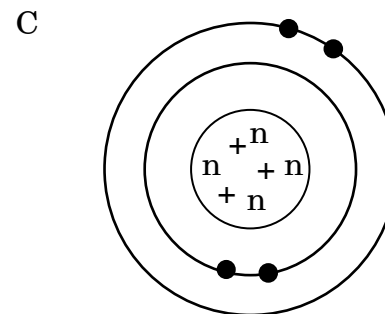
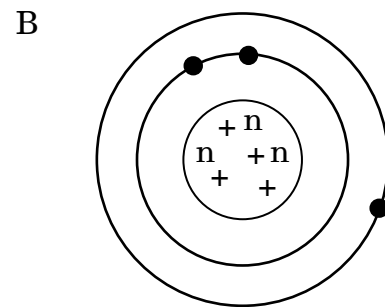
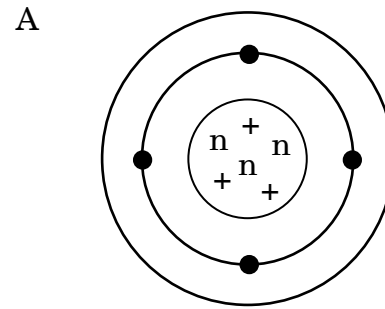
8. How many protons are in an atom of bromine?

- A 115
- B 80
- C 45
- D 35

9. An element with an atomic number of 51 and an atomic mass of 121 has how many neutrons in each atom?

- A 51
- B 70
- C 121
- D 172

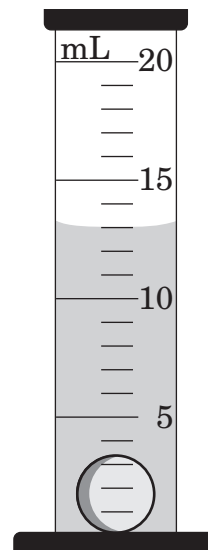
10. Which diagram represents an electrically neutral atom?



11. What is the mass number in atomic mass units of an atom with 14 protons, 14 electrons, and 16 neutrons?
- A 14 amu
  - B 16 amu
  - C 30 amu
  - D 44 amu
12. What is the atomic number of carbon-14?
- A 6
  - B 7
  - C 12
  - D 14
13. Atomic masses are usually expressed as averages due to the existence of what phenomenon?
- A isotopes
  - B radioactive decay
  - C electrons
  - D man-made elements
14. How do the atoms of carbon-12 and carbon-14 differ?
- A atomic number
  - B number of electrons
  - C number of protons
  - D number of neutrons

15. Chlorine has two naturally occurring isotopes, chlorine-35 and chlorine-37. The atomic mass of naturally occurring chlorine is 35.45. Which statement is correct?
- A Chlorine-35 is more abundant.
  - B Chlorine-37 is more abundant.
  - C Chlorine-36 is more abundant.
  - D Chlorine-35 and chlorine-37 are equally abundant.

16. This diagram shows a marble with a mass of 3.8 g that was placed into 10 mL of water.



What is the density of the marble?

- A  $0.79 \text{ g/cm}^3$
- B  $0.95 \text{ g/cm}^3$
- C  $1.05 \text{ g/cm}^3$
- D  $1.27 \text{ g/cm}^3$

17. Several common metals are listed in this chart.

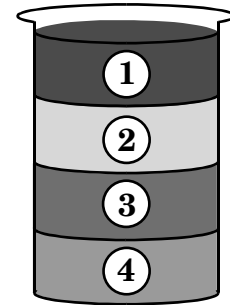
**Common Metals**

<b>Metal</b>	<b>Density (g/cm<sup>3</sup>)</b>
aluminum	2.7
iron	7.9
lead	11.4
silver	10.5

Assuming equal masses of each, a cube of which metal would have the **greatest** volume?

- A aluminum
- B iron
- C lead
- D silver

18. This diagram represents four different liquids that have been poured into a container and have separated.



Which liquid has the greatest density?

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

19. This chart represents the melting points and boiling points for four substances.

**Melting and Boiling Points of Substances**

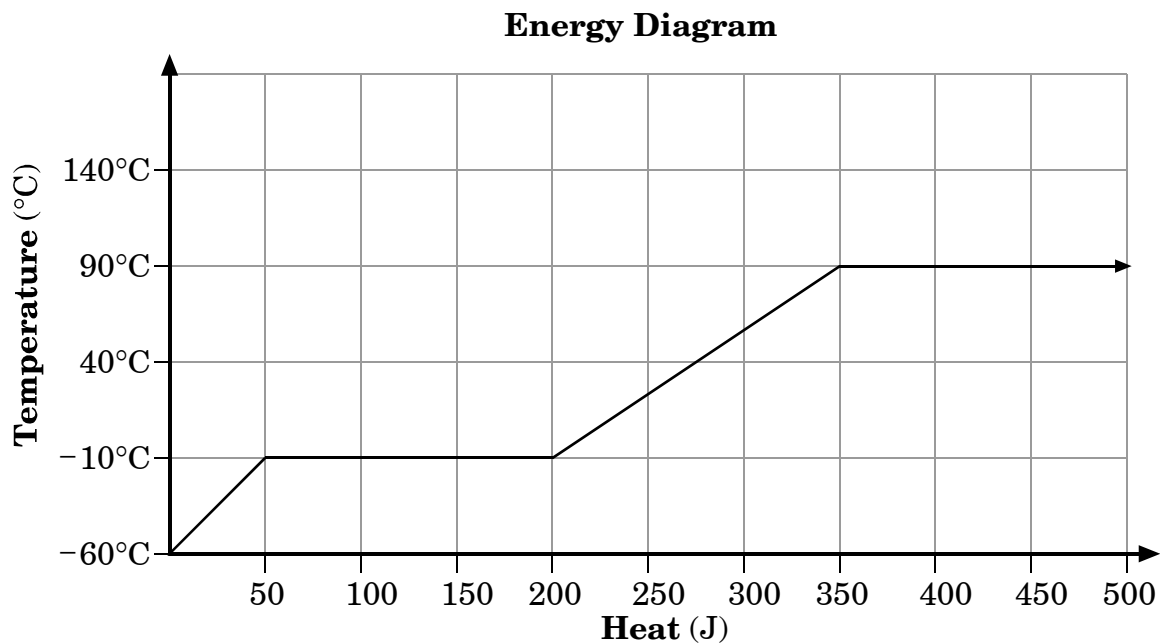
<b>Name</b>	<b>Melting Point (°C)</b>	<b>Boiling Point (°C)</b>
Chlorine	-101	-35
Nitrogen	-210	-196
Oxygen	-218	-183
Hydrogen	-259	-253

Which substance is a solid at  $-200^{\circ}\text{C}$ ?

- A Chlorine
- B Nitrogen
- C Oxygen
- D Hydrogen



20. A solid substance is heated at a uniform rate. This graph shows how the temperature of the substance changes as heat is added.



According to the energy diagram shown, the substance will boil at what temperature?

- A -60°C
- B -10°C
- C 90°C
- D 140°C

## End of Goal 5 Sample Items

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# Physical Science Goal 5

## Sample Items Key Report

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- 1 Objective: 5.01**  
Develop an understanding of how scientific processes have led to the current atomic theory.
- a. Dalton's atomic theory.
  - b. J.J. Thomson's model of the atom.
  - c. Rutherford's gold foil experiment
  - d. Bohr's planetary model.
  - e. Electron cloud model.
- Thinking Skill:** Analyzing **Correct Answer:** B
- 2 Objective: 5.01**  
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  - e. Electron cloud model.
- Thinking Skill:** Knowledge **Correct Answer:** D
- 3 Objective: 5.01**  
Develop an understanding of how scientific processes have led to the current atomic theory.
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  - c. Rutherford's gold foil experiment
  - d. Bohr's planetary model.
  - e. Electron cloud model.
- Thinking Skill:** Knowledge **Correct Answer:** A
- 4 Objective: 5.01**  
Develop an understanding of how scientific processes have led to the current atomic theory.
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  - e. Electron cloud model.
- Thinking Skill:** Knowledge **Correct Answer:** C
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