Unit 6 · Atomic Structure

WORKSHEET

Full marks 42

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 42

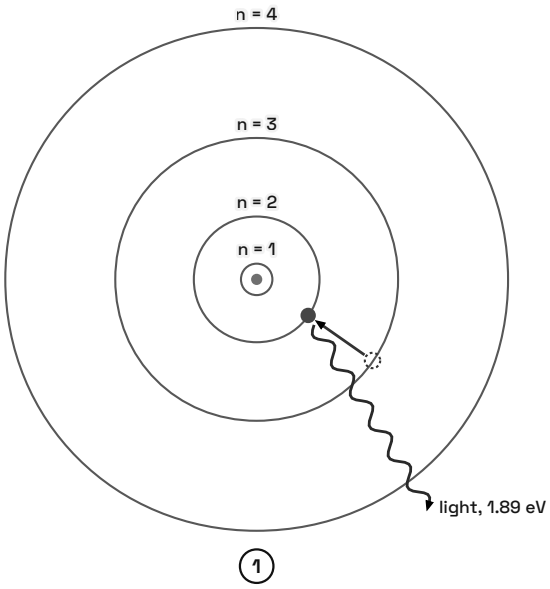
1 Key words [3]

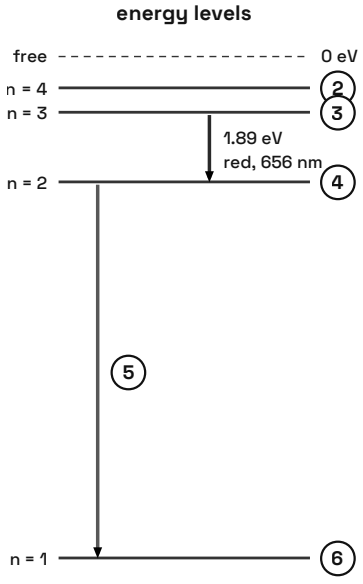
Match each word in Column A with its description in Column B. Write the letter in the box. One description in Column B is not needed. Each match carries 0.5 mark.

Column A		Column B
1. cathode rays	☐	**a.** same number of electrons, different numbers of protons
2. canal rays	☐	**b.** same number of neutrons, different numbers of protons
3. nucleons	☐	**c.** same mass number, different atomic numbers
4. isotopes	☐	**d.** protons and neutrons together
5. isobars	☐	**e.** same atomic number, different mass numbers
6. isotones	☐	**f.** fast electrons streaming from the negative plate of a discharge tube
		g. positive rays from a gas, passing back through holes in the cathode

2 Fill in the diagram [3]

The diagram shows the first four energy levels of the hydrogen atom by Bohr's model. Use $E_n = -\frac{13.6}{n^2}$ eV to fill in the energy of each level and of the long arrow (the jump from level 2 to level 1). The blank under the orbits is the ratio of their radii. Each carries 0.5 mark.





1. _____ **2.** _____

3. _____ **4.** _____

5. _____ **6.** _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. The particle discovered by James Chadwick in 1932 is the: [1]

a. electron **b.** proton

c. neutron **d.** alpha particle

ii. Which part of Dalton's atomic theory is still accepted without change? [1]

a. atoms are indivisible

b. all atoms of an element have the same mass

c. an atom is the smallest particle that takes part in a chemical reaction

d. atoms of different elements always have different masses

iii. In the gold foil experiment, the fact that a very few alpha particles bounced back showed that: [1]

a. electrons are very light

b. the positive charge and mass of an atom are concentrated in a tiny nucleus

c. most of the atom is empty space

d. gold atoms are negatively charged

iv. According to Bohr, the angular momentum of an electron in an allowed orbit is: [1]

a. nh **b.** $\frac{nh}{2\pi}$

c. $\frac{h}{2\pi n}$ **d.** $\frac{2\pi}{nh}$

v. Which pair are isotones? [1]

a. ${}^{40}_{18}\text{Ar}$ and ${}^{40}_{20}\text{Ca}$

b. ${}^{12}_{6}\text{C}$ and ${}^{13}_{6}\text{C}$

c. ${}^{23}_{11}\text{Na}$ and ${}^{24}_{12}\text{Mg}$

d. ${}^{1}_{1}\text{H}$ and ${}^{2}_{1}\text{H}$

4 Very short answers [4]

Write very short answers to the following questions.

a. What is one atomic mass unit (1 u)? [1]

b. Who first measured the charge on an electron, and with what? [1]

c. How many electrons can the M shell hold at most? [1]

d. Why does Bohr's model need a rule that an electron in a stationary orbit gives out no energy? [1]

5 Short answers [8]

Write short answers to the following questions.

a. Give a reason: an atom is electrically neutral. [2]

b. Give a reason: isotopes of an element have the same chemical properties. [2]

c. Dalton said that atoms of one element are alike in mass and that atoms of different elements are different. Name the kind of atoms that shows each of these needs changing, with one example of each. [2]

d. Why is the atomic mass of chlorine 35.45 and not a whole number, when mass numbers are always whole numbers? [2]

6 Long answers [8]

Write long answers to the following questions.

a. Describe Rutherford's alpha-ray scattering experiment, with a labeled diagram. Write its observations and conclusions. [4]

b. Write any three postulates of Bohr's atomic model. Give one merit and one limitation. **[4]**

7 Numerical problems **[9]**

Solve the following problems. Show your working.

a. Find the numbers of protons, neutrons and electrons in (i) $^{27}_{13}Al$, (ii) $^{56}_{26}Fe$, (iii) $^{24}_{12}Mg^{2+}$ and (iv) $^{16}_{8}O^{2-}$. **[4]**

Answer:

b. Boron is 19.9% boron-10 (mass 10.013 u) and 80.1% boron-11 (mass 11.009 u). Find the average atomic mass of boron. **[2]**

Answer:

c. Copper has an atomic mass of 63.55 and two isotopes, copper-63 (mass 62.93 u) and copper-65 (mass 64.93 u). Find the percentage of each. **[3]**

Answer:

8 Think [2]

A student says, “Since potassium-40 and calcium-40 have the same mass number, they must behave the same way in reactions.” Explain the mistake.

9 Activity: Find a hidden shape with marbles (not marked)

Your friend hides an object on the floor under a piece of cardboard propped on books. Roll marbles under the cardboard one at a time, aimed at different places, and note where each comes out.

Marble	Aimed at	Came out straight or turned?	Where it came out
1			
2			
3			
4			
5			
6			

Sketch the shape you think is hidden. How is this like Rutherford’s experiment?