



Answer all the questions below.

1. What is the relative atomic mass ( $A_r$ ) of carbon?

a) 6      b) 12      c) 14      d) 16

2. Avogadro's number is:

a)  $6.022 \times 10^{22}$       b)  $6.022 \times 10^{23}$       c)  $6.022 \times 10^{24}$       d)  $6.022 \times 10^{25}$

3. Which of the following compounds has a relative formula mass ( $M_r$ ) of 58.5?

a) NaCl      b) KCl      c)  $\text{CaCl}_2$       d)  $\text{MgCl}_2$

4. Fill in the blanks in the table below which shows the  $M_r$  and the masses of 1 mole for a range of compounds.

Compound	Relative formula mass ( $M_r$ )	Mass of 1 mole/g
Carbon dioxide ( $\text{CO}_2$ )		
Calcium hydroxide - $\text{Ca}(\text{OH})_2$		
Sulfuric acid ( $\text{H}_2\text{SO}_4$ )		
Ammonia ( $\text{NH}_3$ )		

5. Fill in the gaps to complete the sentences below:

The standard used to measure the masses of atoms is \_\_\_\_\_.

The number of particles in one mole of a substance is \_\_\_\_\_.

6. Calculate the relative formula mass ( $M_r$ ) and the mass of 1 mole of nitric acid ( $\text{HNO}_3$ ).

7. Glucose is a sugar molecule with the formula  $\text{C}_6\text{H}_{12}\text{O}_6$

a. What is the mass of 1 mole of glucose?

b. How many glucose molecules are present in 180g of glucose?

8. One mole of oxygen gas ( $\text{O}_2$ ) contains how many oxygen atoms?

9. Explain why  $^{12}\text{C}$  is used as the standard for measuring the relative masses of atoms.

10. Calculate the number of molecules in 0.5 moles of  $\text{H}_2\text{O}$

11. Calculate the number of molecules in 20 moles of nitrogen gas ( $\text{N}_2$ ).

12. Determine the number of carbon atoms in 3 moles of glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ).

13. Calculate the number of hydrogen atoms in 2 moles of water ( $\text{H}_2\text{O}$ ).

## Answers

1. What is the relative atomic mass ( $A_r$ ) of carbon?

- a) 6    b) 12    c) 14    d) 16

Answer: b) 12

2. Avogadro's number is:

- a)  $6.022 \times 10^{22}$     b)  $6.022 \times 10^{23}$     c)  $6.022 \times 10^{24}$     d)  $6.022 \times 10^{25}$

Answer: b)  $6.022 \times 10^{23}$

3. Which of the following compounds has a relative formula mass ( $M_r$ ) of 58.5?

- a) NaCl    b) KCl    c)  $\text{CaCl}_2$     d)  $\text{MgCl}_2$

Answer: a) NaCl

4. Fill in the blanks in the table below which shows the  $M_r$  and the masses of 1 mole for a range of compounds.

Compound	Relative formula mass ( $M_r$ )	Mass of 1 mole/g
Carbon dioxide ( $\text{CO}_2$ )	44	44
Calcium hydroxide - $\text{Ca}(\text{OH})_2$	74	74
Sulfuric acid ( $\text{H}_2\text{SO}_4$ )	98	98
Ammonia ( $\text{NH}_3$ )	17	17

5. Fill in the gaps to complete the sentences below:

The standard used to measure the masses of atoms is \_\_\_\_\_.

The number of particles in one mole of a substance is \_\_\_\_\_.

Answers:  $^{12}\text{C}$  - the carbon 12 isotope,  $6.022 \times 10^{23}$  or simply  $6 \times 10^{23}$

6. Calculate the relative formula mass ( $M_r$ ) and the mass of 1 mole of nitric acid ( $\text{HNO}_3$ ).

Answer:  $M_r = 63$ , mass of 1 mole of nitric acid = 63g

7. Glucose is a sugar molecule with the formula  $\text{C}_6\text{H}_{12}\text{O}_6$

a. What is the mass of 1 mole of glucose?

Answer: 180g

b. How many glucose molecules are present in 180g of glucose?

Answer: Avogadro's number of molecules,  $6.022 \times 10^{23}$

8. One mole of oxygen gas ( $\text{O}_2$ ) contains how many oxygen atoms?

Answer: 1 oxygen molecule contains 2 oxygen atoms

or

10 oxygen molecules contains 20 oxygen atoms

or

$6.022 \times 10^{23}$  oxygen molecules contains  $2 \times 6 \times 10^{23}$  oxygen atoms or 2 moles of oxygen atoms

9. Explain why  $^{12}\text{C}$  is used as the standard for measuring the relative masses of atoms.

Answer: Carbon-12 is used as the standard because it is a stable isotope and provides a convenient scale for measuring atomic masses. The relative atomic mass

scale is based on assigning 12 exactly to the mass of a carbon-12 atom, allowing for a consistent comparison of masses of different atoms.

10. Calculate the number of molecules in 0.5 moles of  $H_2O$

Answer:

Number of molecules = number of moles  $\times$  Avogadro's number

$$= 0.5 \times 6.022 \times 10^{23}$$

$$= 3.011 \times 10^{23} \text{ molecules}$$

11. Calculate the number of molecules in 20 moles of nitrogen gas ( $N_2$ ).

Answer:

Number of molecules = number of moles  $\times$  Avogadro's number

$$= 20 \times 6.022 \times 10^{23}$$

$$= 1.204 \times 10^{24} \text{ molecules}$$

12. Determine the number of carbon atoms in 3 moles of glucose ( $C_6H_{12}O_6$ ).

Answer: 1 mole of glucose contains  $6.022 \times 10^{23}$  molecules of glucose

Each molecule of glucose contains 6 carbon atoms

Number of carbon atoms in 1 mole of glucose =  $6 \times 6.022 \times 10^{23}$

Number of carbon atoms in 3 moles of glucose =  $3 \times 6 \times 6.022 \times 10^{23}$   
 $= 1.08 \times 10^{25}$

13. Calculate the number of hydrogen atoms in 2 moles of water ( $H_2O$ ).

Answer:

1 mole of water contains  $6.022 \times 10^{23}$  molecules

Each molecule of water contains 2 hydrogen atoms

Number of hydrogen atoms in 1 mole of water =  $2 \times 6.022 \times 10^{23}$

Number of hydrogen atoms in 2 moles of water =  $2 \times (2 \times 6.022 \times 10^{23})$

=  $4 \times 6.022 \times 10^{23}$

=  $2.408 \times 10^{24}$  hydrogen atoms