12. Reacting Masses

1. 1 mole of magnesium nitride contains
   A 1 mole of molecules.
   B 2 moles of cations.
   C 2 moles of anions.
   D 5 moles of atoms.

2. 3 moles of iron(III) sulphate contains
   A 3 moles of molecules.
   B 6 moles of cations.
   C 6 moles of anions.
   D 9 moles of atoms.

3. How many atoms are present in 0.300 mole of carbon dioxide molecules?
   (Avogadro constant = 6.02×10^{23} mol^{-1})
   A 0.300
   B 0.900
   C 1.81×10^{23}
   D 5.42×10^{23}

4. How many ions are there in 4.00 moles of calcium nitrate?
   (Avogadro constant = 6.02×10^{23} mol^{-1})
   A 1.81×10^{24}
   B 2.41×10^{24}
   C 7.22×10^{24}
   D 9.63×10^{24}

5. One mole of potassium sulphide contains
   A two moles of potassium ions and one mole of sulphide ions.
   B 6.02×10^{23} potassium ions and $2 \times 6.02 \times 10^{23}$ sulphide ions.
   C equal number of potassium ions and sulphide ions.
   D 2 potassium ions and 1 sulphide ion.

6. Which of the following contains the largest number of moles of ions?
   A 1 mole of chromium(III) sulphate
   B 2 moles of calcium phosphate
   C 3 moles of zinc sulphide
   D 4 moles of calcium carbonate

7. $CO(g)$, $NO_2(g)$ and $N_2(g)$ are composed of atoms of different elements. What is the ratio of the number of atoms in 1 mole of $CO(g)$, 1 mole of $NO_2(g)$ and 2 moles of $N_2(g)$?

A 2 : 3 : 4
B 2 : 3 : 2
C 3 : 4 : 2
D 3 : 4 : 4

8. How many moles of diborane (B_2H_6) contain x hydrogen atoms?
(L represents the Avogadro constant.)

A $\frac{2x}{L}$
B $\frac{L}{2x}$
C $\frac{x}{6L}$
D $\frac{L}{6x}$

9. Element X forms two oxides X_2O and XO. If 1 mole of X_2O contains n atoms, 3 moles of XO would contain

A $\frac{3}{2}n$ atoms.
B $2n$ atoms.
C $3n$ atoms.
D $6n$ atoms.

10. The molecular formula of ozone is O_3. Which of the following statements concerning 1 mole of ozone is / are correct?
(Avogadro constant = $6.02 \times 10^{23}\ mol^{-1}$)

(1) It contains 6.02×10^{23} atoms.
(2) It contains the same number of molecules as 1 mole of $O_2(g)$.
(3) Its mass is the same as 1 mole of $O_2(g)$.

A (1) only
B (2) only
C (1) and (3) only
D (2) and (3) only

11. Which of the following statements concerning 1 mole of iron is / are correct?
(Avogadro constant = $6.02 \times 10^{23}\ mol^{-1}$)

(1) It can form 1 mole of Fe^{3+} ions.
(2) It can form $3 \times 6.02 \times 10^{23}$ Fe^{3+} ions.
(3) Its mass is the same as 3 moles of Fe^{3+} ions.

A (1) only
B (2) only
C (1) and (3) only
D (2) and (3) only

12. Which of the following statements concerning 1 mole of sulphur dioxide are correct?
(Avogadro constant = 6.02×10^{23} mol^{-1}; relative atomic masses: C = 12.0, O = 16.0)

(1) It contains 3 moles of atoms.
(2) It contains the same number of molecules as 1.5 moles of $O_2(g)$.
(3) It contains the same number of molecules as 44.0 g of $CO_2(g)$.

A (1) and (2) only
B (1) and (3) only
C (2) and (3) only
D (1), (2) and (3)

13. How many moles of atoms are there in 4.65 g of phosphorus?
(Relative atomic mass: P = 31.0)

A 0.150 mol
B 0.500 mol
C 1.00 mol
D 1.50 mol

14. How many moles of formula units ($ZnSO_4 \bullet 7H_2O$) are there in 187 g of zinc sulphate-7-water?
(Relative atomic masses: H = 1.0, O = 16.0, S = 32.1, Zn = 65.4)

A 0.350 mol
B 0.500 mol
C 0.650 mol
D 0.800 mol

15. How many ions are there in 52.8 g of iron(III) sulphate?
(Relative atomic masses: O = 16.0, S = 32.1, Fe = 55.8; Avogadro constant = 6.02×10^{23} mol^{-1})

A 7.95×10^{22}
B 1.99×10^{23}
C 3.97×10^{23}
D 7.94×10^{23}

16. The molecular formula of a gas is X_3. If the Avogadro number is L mol^{-1}, how many atoms are there in 48.0 g of X_3?
(Relative atomic mass: X = 16.0)

A $\frac{L}{2}$
B L
C 2L
D 3L

17. The relative atomic masses of hydrogen and oxygen are 1.0 and 16.0 respectively. Which of the following statements concerning 54.0 g of water is correct?
(Avogadro constant = 6.02×10^{23} mol^{-1})

A It contains 4 moles of oxygen atoms.
B It contains 6 moles of hydrogen atoms.
C It contains $6 \times 6.02 \times 10^{23}$ molecules.
D It contains $8 \times 6.02 \times 10^{23}$ atoms.

18. If there are x molecules in 9.50 g of fluorine, how many molecules are present in 8.00 g of sulphur dioxide?
(Relative atomic masses: O = 16.0, F = 19.0, S = 32.1)

A $\frac{x}{2}$
B x
C $2x$
D $4x$

19. If 2.0 g of carbon monoxide gas contain x atoms, how many atoms are present in 1.0 g of hydrogen gas?
(Relative atomic masses: H = 1.0, C = 12.0, O = 16.0)

A $\frac{7}{2}x$
B $\frac{11}{2}x$
C $7x$
D $11x$

20. Which of the following gases contains the SMALLEST number of molecules?
(Relative atomic masses: H = 1.0, C = 12.0, N = 14.0, O = 16.0, S = 32.1)

A 20 g of SO_2
B 20 g of CO_2
C 20 g of NH_3
D 20 g of C_3H_6

21. Which of the following gases contains the largest number of molecules?
(Relative atomic masses: H = 1.0, C = 12.0, N = 14.0, O = 16.0, F = 19.0, S = 32.1)

A 10 g of hydrogen fluoride
B 20 g of carbon monoxide
C 30 g of hydrogen sulphide
D 40 g of nitrogen dioxide

22. Which of the following gases contains the same number of atoms as 22.0 g of carbon dioxide?
(Relative atomic masses: H = 1.0, C = 12.0, N = 14.0, O = 16.0, Cl = 35.5)

A 4.8 g of methane
B 8.5 g of ammonia
C 18.3 g of hydrogen chloride
D 42.0 g of nitrogen

23. A solid mixture of iron(II) nitrate and iron(II) carbonate contains 2.0 moles of nitrate ions and 2.4 moles of iron(II) ions. How many moles of carbonate ions are present in the mixture?

A 1.0 mol
B 1.4 mol
C 1.7 mol
D 2.0 mol

24. 1 mole of sulphur atoms has a mass twice that of 1 mole of oxygen atoms. Which of the following statements is / are correct?

(1) 2 g of sulphur contains twice the number of atoms as 1 g of oxygen.
(2) The number of atoms in 1 mole of sulphur atoms is the same as that in 1 mole of oxygen atoms.
(3) The number of S^{2-} ions formed from 1 mole of sulphur atoms is twice that of O^{2-} ions formed from 1 mole of oxygen atoms.

A (1) only
B (2) only
C (1) and (3) only
D (2) and (3) only

25. What is the percentage by mass of water of crystallization in $FeSO_4 \bullet 7H_2O$?
(Relative atomic masses: H = 1.0, O = 16.0, S = 32.1, Fe = 55.8)

A 45.3%
B 56.0%
C 72.0%
D 84.6%

26. What is the percentage by mass of X in $K_2X_2O_7$?
(Relative atomic masses: O = 16.0, K = 39.1, X = 52.0)

A 17.7%
B 25.1%
C 35.4%
D 40.8%

27. What is the percentage by mass of oxygen in $Al(NO_3)_3 \bullet 6H_2O$?
(Relative atomic masses: H = 1.0, N = 14.0, O = 16.0, Al = 27.0)
A 74.8%
B 44.9%
C 33.6%
D 29.9%

28. The relative atomic mass of element X is 69.7. It forms an oxide containing 25.6% of oxygen by mass. What is the mole ratio of X to oxygen in the oxide?
(Relative atomic mass: O = 16.0)
A 1 : 2
B 1 : 3
C 2 : 3
D 2 : 5

29. The molar mass of a hydrated sulphate ($XSO_4 \bullet 5H_2O$) is 250.1 g mol^{-1}. What mass of water of crystallization is contained in 30.0 g of the sulphate?
(Relative atomic masses: H = 1.0, O = 16.0)
A 10.8 g
B 18.0 g
C 14.4 g
D 21.6 g

30. Which of the following fertilizers contains the LOWEST percentage by mass of nitrogen?
(Relative atomic masses: H = 1.0, N = 14.0, O = 16.0, Na = 23.0, S = 32.1, Cl = 35.5, K = 39.1)
A Potassium nitrate
B Sodium nitrate
C Ammonium chloride
D Ammonium sulphate

1	C	2	B	3	D	4	C	5	A
6	B	7	A	8	C	9	B	10	B
11	A	12	B	13	A	14	C	15	C
16	D	17	B	18	A	19	C	20	A
21	C	22	A	23	B	24	B	25	A
26	C	27	A	28	C	29	A	30	A