

Instructions

- If a question has 2 steps round the first answer off to 4 decimal places, and always round the final answers off to 2 decimal places
- use a comma for decimal numbers
- when typing a unit with exponents, just type them as normal numbers, eg mol.dm-3 (no spaces)

| | | |
|-------------------|--|---------------------|
| $n = \frac{m}{M}$ | Avogadro's constant: $N_A = 6.02 \times 10^{23}$ Molar gas volume at STP: $V_m = 22.4 \text{ dm}^3$ | $n = \frac{N}{N_A}$ |
| $c = \frac{n}{V}$ | $c = \frac{m}{MV}$ | $n = \frac{V}{V_m}$ |

Question 1**Multiple choice questions: Only write the letter of the correct option:**1.1 The number of moles in 22,4 dm³ of helium at STP is equal to ...

- A 0,5 mol of He atoms
- B 1 mol of He atoms
- C 1,5 mol of He atoms
- D 2 mol of He atoms

(2)

1.2 A molecule has an empirical formula of C_2H_7 . So, its true/molecular formula could be ...

- A C_3H_8
- B C_4H_9
- C C_6H_{21}
- D $CH_{3,5}$

1.3 What is the relative molar mass of $Al_2(CO_3)_3$?

- A $186g\cdot mol^{-1}$
- B $114g\cdot mol^{-1}$
- C $234g\cdot mol^{-1}$
- D $138g\cdot mol^{-1}$

Question 2

2.1 Calculate the number of moles in 46.6g aluminum metal.

(3)

| | |
|--------------------|------|
| Answer (2 deci) | Unit |
|--------------------|------|

n = _____

{only type in final answer with the correct unit, correct to 2 decimal places}

2.2 Calculate the mass of 2.5 moles of calcium hydroxide $\text{Ca}(\text{OH})_2$

(3)

Answer (2
deci)

Unit

$m =$ _____

{only type in final answer with the correct unit, correct to 2 decimal places}

Question 3

3.1 How many particles are there in 1 mole of any substance? (1)

= _____ $\times 10$ particles {2 decimals}

3.2 Calculate the number of molecules in 10 moles

of sodium hydroxide (NaOH). (3)

$n =$ _____ $\times 10$ _____ {2 decimals}

3.3 Calculate the number of atoms in 18 g of Bromine gas. (5)

***Hint – this calculation requires 2 steps.**

Step one answer = _____ {leave as 4 decimal places}

Step two answer = _____ $\times 10$ _____ {4 decimal places}

Step three answer = _____ $\times 10$ _____ {2 decimal places}

Question 4

4.1 Calculate the concentration of a sodium nitrate solution if 6.25g of NaNO_3 is dissolved in water to make a 220cm^3 solution. (5)

*Hint – this calculation requires 2 steps, unless you use the shortcut formula of

$$c = \frac{m}{MV}$$

If you complete the question in 2 steps:

Step one answer = _____ {leave as 4 decimal places}

Step two answer = _____ { 2 decimal places}

Or (Try this one 😊) $c = \frac{m}{MV}$

= _____ { 2 decimals}

Question 5

A component of protein called serine has an approximate molar mass of 105gmol^{-1} . If the percent composition is as follows, what is the

- a) empirical and
- b) molecular formula of serine?

$$\text{C} = 34.95\% \quad \text{H} = 6.844\% \quad \text{O} = 46.56\% \quad \text{N} = 13.59\%$$

Answer

Unit



(7)

a) C: n = _____ {4 decimals}

H: n = _____ {3 decimals}

O: n = _____ {2 decimals}

N: n = _____ {4 decimals}

Then when you simplify the above ratio, the empirical formula will be:

C H O N

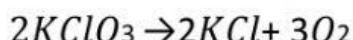
b) calculate the ratio to determine the molecular/true formula

ratio = x _____

Thus the molecular formula is C H O N

Question 6

*Hint – mole ratio question



What mass of potassium chlorate ($KClO_3$) should be heated to produce 24g of O_2 ?

(5)

| $2KClO_3$ | $2KCl$ | $3O_2$ |
|----------------------------|--------|----------------------------|
| Step 2 n = _____ | | Step 1 n = _____ |
| Step 3 m = _____ | | |

Question 7

Consider the balanced equation:



42.5g of NH_3 and 80g of O_2 are added together.

7.1 Show by means of calculation which reactant is used up first (limiting reagent).

(6)

| 4NH_3 | 5O_2 | 4NO | $6\text{H}_2\text{O}$ |
|--|--|--------------------------------|---|
| Given: $n = \underline{\quad} \underline{\quad}$ | $n = \underline{\quad} \underline{\quad}$ | | |
| Needed: $n = \underline{\quad} \underline{\quad}$ Limiting / excess | $n = \underline{\quad} \underline{\quad}$ Limiting / excess | | |

7.2 Calculate the mass of H_2O that forms in the reaction.

| 4NH_3 | 5O_2 | 4NO | $6\text{H}_2\text{O}$ |
|----------------------------------|---------------------------------|--------------------------------|--|
| | | | $n = \underline{\quad} \underline{\quad}$ $m = \underline{\quad} \underline{\quad}$ |

Question 8



280 g of impure sodium hydroxide is added to a hydrochloric acid solution. If 355 g of sodium sulphate forms at the end of the reaction, calculate the percentage purity of the sodium hydroxide sample. [6]

The format below is there to help you:

{The steps have also been numbered to assist}

| 2NaOH | H_2SO_4 → | Na_2SO_4 |
|---|------------------------------|--|
| Step 2: $n = \underline{\hspace{2cm}} \underline{\hspace{2cm}}$ step 3: $m = \underline{\hspace{2cm}} \underline{\hspace{2cm}}$ step 4: $\% \text{ purity} = \underline{\hspace{2cm}} \%$ | | Step 1: $n = \underline{\hspace{2cm}} \underline{\hspace{2cm}}$ (6) |