PHYSICAL SCIENCE : GRADE 10 **TEST 5**

QUANTITATIVE ASPECTS OF CHEMICAL CHANGE

FORMULAE $n = \frac{m}{M}$ $n = \frac{V}{Vo}$ $n = \frac{No}{NA}$ $c = \frac{n}{V}$

CONSTANTS

Avogadro's constant	N_A	$6{,}02 \times 10^{23}$ mol^{-1}
Molar gas volume at STP	V_O	22,4 dm^3.mol^{-1}

INSTRUCTIONS

Write all numbers with a comma e.g. 0,71

Do not leave spaces between the number and the unit eg 0,71Hz

If there are two steps to a calculation there will be two blocks provided. Fill in the answers in the correct order.

Round final answers off to two decimal places where necessary

When answers are very small or very big, write in scientific notation and still round off to two decimal places.

QUESTION 1 : MULTIPLE CHOICE [5]

Four possible options are provided as answers to the following questions.
Each question has only one correct answer. Write only the letters (A – D) below the question number (1.1 – 1.4) in the box.

1.1 The molar mass of one formula unit of $MgSO_4 \cdot 7H_2O$ is

A. 123 g.mol^{-1}
B. 145 g.mol^{-1}
C. 246 g.mol^{-1}
D. $1{,}51 \times 10^4$ g.mol^{-1}

1.2 The percentage (%) sodium present in one formula unit of NaCl is

A. 58,50
B. 39,32
C. 39,29
D. 28

1.3 The percentage (%) of the element oxygen present in $CuSO_4 . 5H_2O$ is

A. 58
B. 40
C. 36
D. 144

1.4 For the reaction $4\ NH_3 + 5\ NO \rightarrow 4\ N_2 + 6\ H_2O$, the number of moles of water that can be produced from 3 moles of ammonia is

A. 0,67
B. 2
C. 3
D. 4,5

1.5 The empirical formula of a compound is C_2H_2O and the molar mass of the compound is 126 $g.mol^{-1}$. The true formula for the compound is

A. CHO
B. C_2H_2O
C. $C_4H_4O_2$
D. $C_6H_6O_3$

QUESTION 2 : TERMINOLOGY **[7]**

Give one word/ term for each of the following descriptions.

2.1 The whole integer ratio or relationship between the relative quantities of substance taking part in a reaction. (1)

2.2 The number of moles of dissolved solute per 1 litre of solvent. (1)

2.3 A measure of how much product is formed from a reaction compared to how much product should have formed based on the quantity of reactant used. (2)

2.4 The simplest whole integer ratio showing how atoms combine in a compound. (2)

2.5 A type of solution whose exact concentration is known precisely. (1)

QUESTION 3 **[3]**

Indicate whether the following statements are **TRUE** or **FALSE.**

Write down only T or F

3.1 The empirical formula for P_2O_5 is P_4O_{10} (1)

3.2 From the balanced equation $N_2 + 3H_2 \rightarrow 2NH_3$

6 moles of hydrogen gas will produce 5 moles of ammonia (1)

3.3 The concentration of a solution can be increased by adding more solute. (1)

QUESTION 4

Calculate the percentage composition of potassium fluoride (KF) (4)

Molar mass (M) of KF = 58 $g.mol^{-1}$

$$\% K = \frac{\quad}{\quad} \times 100\ \%$$

$$\% K = \quad \% \quad \{2 \text{ decimals}\}$$

$$\% F = \frac{\quad}{\quad} \times 100\ \%$$

$$\% F = \quad \%$$

QUESTION 5

Calculate the percentage of the element oxygen in the ionic compound $Ca(OH)_2$ (4)

molar mass (M) of $Ca(OH)_2$ = $g.mol^{-1}$

$$\% O = \frac{\quad}{\quad} \times 100 \%$$

$$\% O = \quad \%$$

QUESTION 6

Propane (C_3H_8) gas is a hydrocarbon. It burns in oxygen gas as indicated in the balanced equation

$$C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_20$$

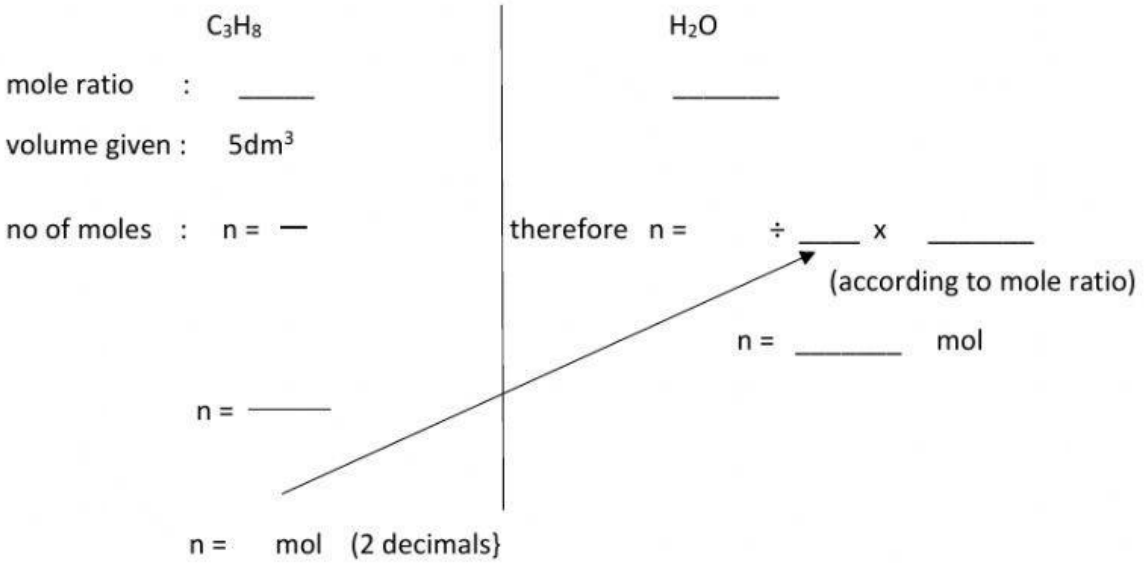
6.1 All substances are in the gaseous phase and the temperature and pressure are kept constant.
What is the volume ratio of propane to carbon dioxide? (2)

:

6.2 What volume of carbon dioxide will $10cm^3$ of propane yield? (1)

_____ cm^3

6.3 Calculate the number of moles of water produced from 5dm^3 of propane. (6)



QUESTION 7

7.1 Convert the following {write in decimal notation} (3)

7.1.1 1 dm^3 → cm^3

7.1.2 2 litres → dm^3

7.1.3 30 ml → dm^3

7.2 Calculate the concentration of a solution containing 3,5 moles of salt dissolved into 0,25 litres of water. (3)

c =

c =

c = mol.dm^{-3}

7.3 Calculate the number of moles of ammonium sulphate that must be dissolved in 2 dm^3 of water to create a solution of concentration 0,75 mol.dm^{-3} (3)

c = ———

n = ____ x _____ {manipulate the formula}

n = ____ x _____ {now only substitute the values}

n = _____ mol

7.4 20g of Li_2CO_3 is dissolved into 500 cm^3 of distilled water.

7.4.1 Give the chemical name for the solute. (1)

7.4.2 Write the chemical formula for the solvent. (1)

7.4.3 Calculate the concentration of the solution. (6)

Step 1 : n = ——

n = ——

n = _____ mol

Step 2 : V = —— {this is the conversion for the volume}

V = dm^3

Step 3 : c = ——

c = ——

c = _____ $mol.dm^{-3}$

QUESTION 8

A hydrocarbon compound has a relative formula mass of 132 $g.mol^{-1}$.

It contains 54,5% carbon, 9,1% hydrogen and 36,4% oxygen by mass.

Calculate the

8.1 empirical formula of the compound (6)

Let 1% = 1g , then in 100g of substance

$n(C) = \frac{m}{M}$ = —— = mol

$n(H) = \frac{m}{M}$ = —— = mol

$n(O) = \frac{m}{M}$ = —— = mol

therefore

molar ratio of C : H : O

: :

so

actual ratio : :

therefore

empirical formula = C H O

8.2 the molecular formula of the compound (3)

molecular formula mass = 132,12 g (given)

and

empirical formula mass = _____

So

$\frac{molecular\ formula\ mass}{emperical\ formula\ mass}$ = ——— =

therefore

molecular formula = empirical formula x

molecular formula = C H O

QUESTION 9 **(3)**

A sample of sea salt mined in Russia was tested for purity. 250g of the solid was used but after analysis it was discovered that only 238.7g was pure sodium chloride.

Calculate the percentage purity of the product.

percentage purity = ——— x 100 %

percentage purity = %

QUESTION 10 **(11)**

For the reaction **N_2 + 3 H_2 → 2 NH_3** . It was found that 10 g of H_2 produced only a 75% yield of ammonia.

Calculate the actual mass of product formed in this reaction.

	N_2	+	3 H_2	→	2 NH_3
Molar ratio	1	:	3	:	2
Given mass:			10 g H_2		theoretical yield:

n = ——

n = ——

n = mol

therefore n (NH_3) = 5 ÷ ____ x _____

n = mol

n = $\frac{m}{M}$

m = ____ x _____

m = ____ x _____

m = _____ g

% yield = $\frac{actual\ mass}{expected\ mass}$ x 100 %

actual mass = $\frac{expected\ mass\ x\ \%\ yield}{100}$

actual mass = $\frac{(\quad)\ x\ (\quad)}{100}$

actual mass = g