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Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES

MARKING GUIDELINES

COMMON TEST

SEPTEMBER 2024

NATIONAL

SENIOR CERTIFICATE

GRADE 11

NB: This marking guideline consists of 6 pages.

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QUESTION ONE

1.1 C ✓✓
1.2 B ✓✓
1.3 D ✓✓
1.4 C ✓✓
1.5 A ✓✓ **[10]**

QUESTION TWO

2.1 The mass of one mole of a substance. ✓✓ (2)

2.2 $M (C_{12}H_{22}O_{11}) = 12(12) + 22(1) + 11(16)$
$= 144 + 22 + 176$
$= 342\ g.mol^{-1}$ ✓

$\% C = \frac{144}{342} \times 100 = 42,11\%$ ✓

(2)

2.3

Mass of C in 6,2g of CO_2:
$\frac{12}{44} \times 6,2 = 1,69g$✓
∴ mass of C in C_xH_y is 1,69 g✓

Mass of H in C_xH_y = 1,97 – 1,69✓
= 0,28g

	C	H
Mass	1,69 g	0,28 g
n = m/M	$\frac{1,69}{12}$✓	$\frac{0,28}{1}$✓
	= 0,14	= 0,28
Divide by smallest	$\frac{0,14}{0,14}$	$\frac{0,28}{0,14}$
Ratio	1	2
Empirical formula is CH_2✓		

(6)

2.4.1 $\frac{M}{M+71}$✓✓ $\times 100 = 44,1$✓ OR $\frac{71}{M+71}$✓ $\times 100 = 55,9$✓

$M = 56\ g \cdot mol^{-1}$✓

(4)

2.4.2 $\frac{x(35,5)}{56+x(35,5)}$✓ $= \frac{65,5}{100}$✓

$x = 3$✓ (4)

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QUESTION 3

3.1 The amount of solute per dm^3 of solution. / The number of moles of a substance per unit volume. ✓✓ (2)

3.2 No more carbon dioxide is produced. ✓/ The reaction has ended / All the $CaCO_3$ has reacted. (1)

3.3
$$n = \frac{V}{V_m} \checkmark$$
$$= \frac{500}{24000} \checkmark$$
$$= 0,0208 \text{ mol} \checkmark$$
(3)

3.4 **POSITIVE MARKING FROM 3.3**

MARKING CRITERIA:

- Substitution / answer: calculation of initial moles of HCl. ✓
- Apply ratio of moles of HCl to CO_2.(2:1). ✓
- Subtracting moles that reacted from initial moles of HCl. ✓✓
- Formula to calculate concentration. ✓
- Substitution into concentration formula. ✓
- Final answer. ✓

(7)

OPTION 1

$n_i = cV = 0,5 \times 0,3$✓
$= 0,15$ mol

$n_{reacted} = 2 \times 0,0208$✓
$= 0,0416$ mol

$n_{excess} = n_i - n_{reacted}$
$= 0,15 - 0,0416$✓✓
$= 0,1084$ mol

$c = \frac{n}{V}$✓
$= \frac{0,1084}{0,3}$✓
$= 0,361 \text{ mol.dm}^{-3}$✓

OPTION 2

	$CaCO_3$	2HCl	$CaCl_2$	H_2O	CO_2
Ratio	1	2	1	1	1
Initial		0,15	✓		0
Change		-0,0416	✓		0,0208
End		0,1084	✓✓		

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QUESTION 4

4.1. $n\ (NO_3^-) = C \times V$
$= 0,15 \times 0,25$ ✓
$= 0,0375$ mol
$n\ (Ca(NO_3^-)) = \frac{1}{2}(0,0375)$ ✓

$= 0,01875$ mol

∴ mass of $Ca(NO_3)_2 \cdot 4H_2O$ used
$m = nM$ ✓
$= 0,01875(164 + 4(18))$ ✓
$= 4,425$ g✓ (5)

4.2.1 The reactant that is used up first/completely in a chemical reaction. ✓✓ (2)
OR the reactant that determines the amount of product that is formed

4.2.2 $n\ (C_7H_6O_3) = \frac{m}{M}$

$= \frac{14}{138}$ ✓
$= 0,10$ mol

$n\ (C_4H_6O_3) = \frac{m}{M}$

$= \frac{10}{102}$ ✓
$= 0,10$ mol

From balanced equation:
$n(C_7H_6O_3) : n(C_4H_6O_3)$
2 : 1

∴ 0,1 mol of $C_7H_6O_3$ needs 0,05 mol of $C_4H_6O_3$ ✓

∴ The limiting reactant is $C_7H_6O_3$ ✓ (4)

4.2.3 $n\ (C_9H_8O_4) = \frac{m}{M}$

$0,1$✓ $= \frac{m}{180}$✓

∴m = 18 g (18,26 g) ✓

$\%\ \text{yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100$

$= \frac{11,5}{18} \times 100$ ✓

$= 63,90\%$ (62,98%)✓

(5)
[16]

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QUESTION 5

5.1 Boyle's Law ✓ (1)

5.2 What is the relationship between the pressure exerted and the volume occupied by a fixed mass of (dry) gas at constant temperature? ✓✓ (2)

5.3 Mass (of gas) ✓ or
Temperature (of gas) ✓ (2)

5.4 At 200kPa $1/v = 6,7 \times 10^{-2}$ ✓

$$\therefore v = \frac{1}{6,7 \times 10^{-2}} \checkmark$$

$v = 14,93\ cm^{-3}$ ✓ (3)

5.5 $p_1v_1 = p_2v_2$ ✓

$120(25) = p_2\ (11,11)$ ✓ (or any other correct combinations for p_1 and v_1 from the graph)

$p_2 = 270,03\ kPa$ ✓ (3)

5.6 The particles of the ideal gas: (any 2)

- Occupy no volume.
- Are identical in all ways.
- Exert no forces on each other except during a collision.
- All collisions between gas molecules are completely elastic. (2)

[13]

QUESTION 6

6.1 Exothermic. ✓
$\Delta H < 0$ ✓ / $E_{products} < E_{reactants}$ (2)

6.2 The minimum energy needed for a reaction to take place ✓✓ (2)

6.3.1 208,2 kJ ✓ (1)

6.3.2 86,5 kJ ✓ (1)

6.3.3 154,3 kJ OR 130,8 kJ ✓ (1)

6.3.4 9,1 kJ ✓ (1)

6.3.5 240,8 kJ ✓ (1)

6.4 $\Delta H = E_{products} - E_{reactants}$

$= 208,2 - 86,5$ ✓ $= 121,7$ kJ ✓ (2)

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6.5.1 Remains the same .✓ (1)

6.5.2 Remains the same.✓ (1)

6.5.3 Decreases.✓ (1)

[14]

QUESTION 7

7.1.1 A base is a proton acceptor. ✓ (1)

7.1.2 NH_3 ✓ and $H_2PO_4^-$ ✓ (2)

7.1.3 A substance that acts as an acid and base. ✓✓ (2)

7.1.4 $H_2PO_4^-$ ✓ (1)

7.2.1 n (Na_2CO_3) = c x V ✓
= 0,2 x 0,02 ✓
= 0,004 mol ✓ (3)

7.2.2 **POSITIVE MARKING FROM QUESTION 7.2.1**

OPTION 1:

n (Na_2CO_3) : n (HCl)
1 : 2

∴ n (HCl) = 2 x 0,04✓ = 0,008 mol

$c = \frac{n}{v}$

$= \frac{0,008}{0,012}$ ✓ ✓

= 0,67 mol.dm^{-3} ✓

OPTION 2:

$\frac{c_A V_A}{c_B V_B} = \frac{n_A}{n_B}$

$\frac{c_A \times 12}{0,2 \times 20}$ ✓ ✓ $= \frac{2}{1}$ ✓

c_A = 0,67 mol·dm^{-3} ✓

(4)

LEAVE OUT (FORMULA NOT GIVEN IN DATA SHEET)
Refer to conversion sheet for question 7

7.2.3 pH = -log[H_3O^+] ✓

= - log (0,67) ✓

= 0,17 ✓ ~~(3)~~

[16]

TOTAL: 100

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