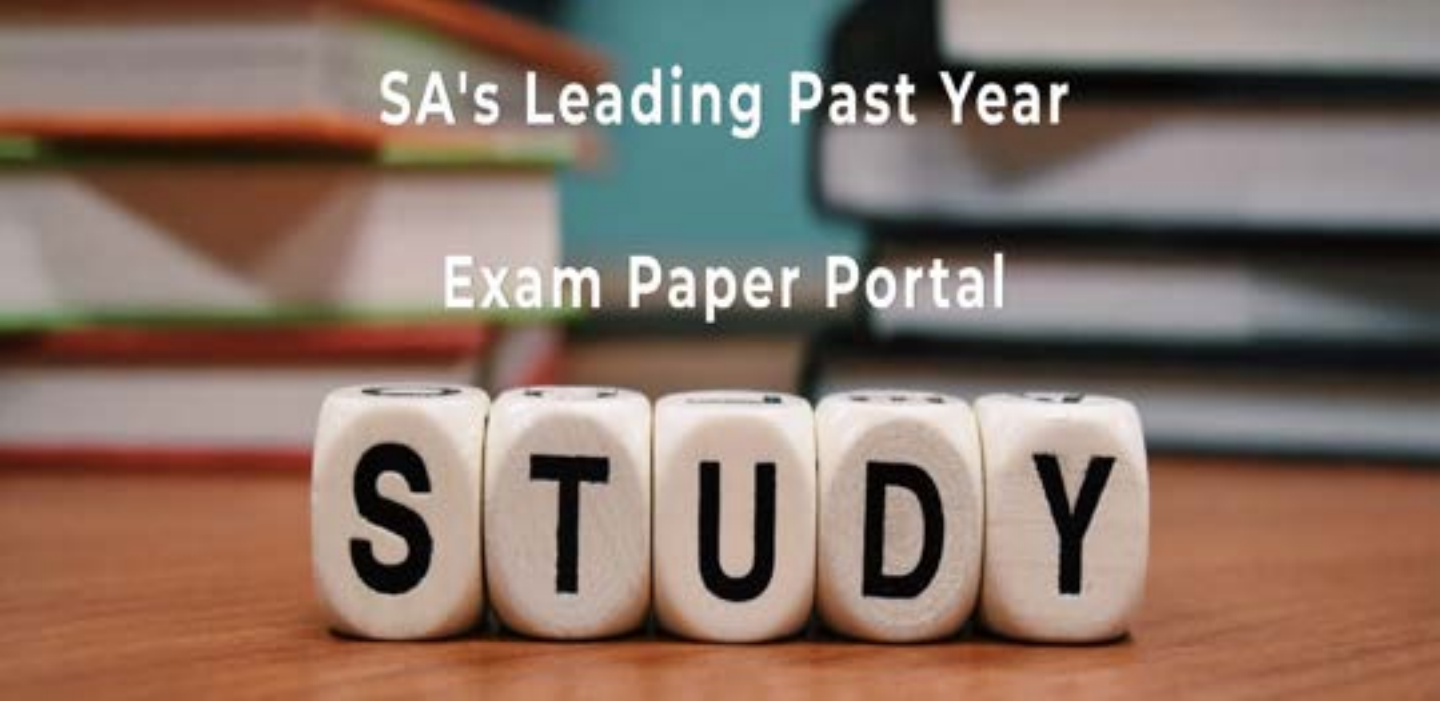

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NATIONAL
SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES

JUNE 2021

MARKING GUIDELINE

MARKS: 75

This marking guideline consists of 6 pages.

QUESTION 1

1.1 D✓✓ (2)

1.2 D✓✓ (2)

1.3 A✓✓ (2)

1.4 C ✓✓ (2)

1.5 D ✓✓ (2)

1.6 C ✓✓ (2)

[12]

QUESTION 2

2.1 The <u>total mechanical energy</u> (sum of gravitational potential energy and kinetic energy) in an <u>isolated system</u> <u>remains constant</u>. ✓✓ (2)

2.2 E_{mech} at the start = E_{mech} at A ✓

$(mgh + ½ mv^2)_{start} = (mgh + ½ mv^2)_A$

$\underline{(6)(9,8)(10)} + ½ (6)(0^2)$✓ = $(6)(9,8)(0) + \underline{½ (6)v^2}$ ✓

$v = 14,00\ m \cdot s^{-1}$ ✓

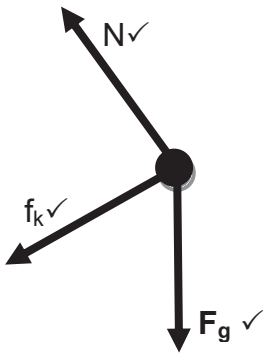
(4)

2.3 The <u>net/total work done</u> on an object is <u>equal to</u> the <u>change in the object's kinetic energy</u> ✓✓

OR

The <u>work done on an object by a resultant/net force</u> <u>is equal</u> to <u>the change in the object's kinetic energy</u>. ✓✓ (2)

2.4



	Accept the following symbols
N✓	F_N/Normal/Normal force
f_k✓	Kinetic friction force/f/F_f/f_r
F_g✓	$_W$/58,8N

Notes
- Mark is awarded for label and arrow.
- Do not penalise for length of arrows.
- Deduct 1 mark for any additional force.
- If force(s) do not make contact with body/dot : *Max:2/*3
- If arrows missing but labels are there: *Max:2/*3

(3)

2.5 OPTION 1

$W_{net} = \Delta E_K$ ✓

$W_f + W_g + W_N = \Delta E_K$

$f_k \Delta x \text{Cos}180^o + mgh + 0 = ½mv_f^2 - ½mv_i^2$

$\underline{20\Delta x \text{cos}180^o}$ ✓ - $\underline{6x9,8x6}$ ✓ = $\underline{½(6)(0) - ½(6)(14)^2}$ ✓

$\Delta x = 11,76$ m ✓

∴ The length of BC is 11,76 m

OPTION 2

$W_{net} = \Delta E_K$ ✓

$W_f + W_g + W_N = \Delta E_K$

$f_k \Delta x \text{Cos}180^o + F_g \Delta x \text{Cos}(270^o + \alpha) + 0 = ½mv_f^2 - ½mv_i^2$

$20\Delta x \text{Cos}180^o + (6)(9,8)(\Delta x)(-\text{Sin}\ \alpha) = ½(6)v_f^2 - ½(6)(14)^2$

$\underline{20\Delta x \text{Cos}180^o}$ ✓ + $\underline{(6)(9,8)(\Delta x)(\ 6/\Delta x)}$ ✓ = $\underline{½(6)(0) - ½(6)(14)^2}$ ✓

$\Delta x = 11,76$ m ✓

∴ The length of BC is 11,76 m

OPTION 3

$W_{nc} = \Delta Ek + \Delta Ep$ ✓

$W_f = \Delta Ek + \Delta Ep$

$\underline{20 \times \Delta x \text{cos}\ 180^o}$ ✓ = 0 - $\underline{½(6)(14)^2}$ ✓ + $\underline{(6-0)(9,8 \times 6)}$ ✓

$\Delta x = 11,76$ m ✓

∴ The length of BC is 11,76 m

NB: If equations of motion are used award =(1/5) (5)

[16]

QUESTION 3

3.1 The change in frequency (or pitch) of the sound detected by a listener because the sound source and the listener have different velocities relative to the medium of sound propagation. ✓✓

OR

It is the change in the observed frequency of a sound wave when the source of sound is moving relative to the listener. ✓✓ (2)

3.2 Towards✓ (1)

3.3 $f_L = \frac{v \mp v_L}{v \mp v_S} f_s$✓

$1290✓ = (\frac{340}{340 - v_S})✓1250✓$

v_s = 10,54 m·s^{-1} ✓

(5)

[8]

QUESTION 4

4.1 Change in concentration/mass/amount ✓ of reactants/products per unit time. ✓

OR

Rate of change in concentration/mass/amount of reactants/products✓✓ (2)

4.2 Sulphuric Acid / H_2SO_4✓ (1)

4.3.1 $n = \frac{V}{V_m}$

$= \frac{1,8816}{22,04}$ ✓

= 0,084 mol

$\therefore n\ Zn = 0,084\ mol$ ✓

Mass = n x RM

= 0,084 x 65 ✓

=5,46g

Mass remaining = 8, 46 – ✓5,46

= 3 g ✓

(5)

4.3.2 ***Positive marking from 4.3.1*** (2)

Rate = $\frac{5,46}{60}$ ✓ $= 0,09\ g.s^{-1}$ ✓ (0,091)

4.4 Experiment I✓ (1)

4.5 ● Increase in concentration increases the number of particles per unit volume.✓
● increase in number of collisions per unit time.✓
● increase in number of effective collisions per unit time.✓
● increase in reaction rate.✓

OR

● Decrease in concentration decreases the number of particles per unit volume.✓
● Decreases in number of collisions per unit time.✓
● Decreases in number of effective collisions per unit time.✓
● Decreases in reaction rate.✓ (4)

[15]

QUESTION 5

5.1.1 When the equilibrium in a closed system is disturbed, the system will re-instate a new equilibrium by favouring the reaction that will oppose the disturbance. ✓✓ (2)

5.1.2 increases. ✓ (1)

5.1.3 Increases✓
- Increase in pressure favours the reaction that decreases the number of moles of gas. ✓
Reverse reaction is favoured✓ (3)

5.2

Marking criteria:

- Calculating the quantity -1,5 mol✓
- Correct mol ratio✓
- Calculating the quantity(mol) at equilibrium of all three substances ✓
- Substitute V = 2 dm^3 to determine concentration at equilibrium of all the substances.✓
- K_c expression✓
- Substitution into K_c expression ✓
- Final answer 4,5✓

	SO_2	O_2	SO_3	
Ratio	2	1	2	
Initial quantity (mol)	4	5,5	0	
Change (mol)	-3	-1,5✓	+3	Using ratio ✓
Quantity at equilibrium (mol)	1	4	3	✓
Equilibrium concentration ($mol \cdot dm^{-3}$)	0,5	2	1,5	Divide by 2 ✓

$$K_c = \frac{[SO_3]^2}{[SO_2]^2[O_2]} \checkmark$$

$$\therefore = \frac{(1,5)^2}{(0,5)^2(2)} \checkmark$$

$$= 4,5 \checkmark$$

No K_c expression, correct substitution. $^6/_7$

Wrong K_c expression $^4/_7$

(7)

[13]

QUESTION 6

6.1.1 Undergoes incomplete ionisation to produce a low concentration of hydronium ions ✓ (1)

6.1.2 INCREASES✓✓ (2)

6.2.1 Proton donor ✓ (1)

6.2.2 At the end of the reaction, **(7)**

$n(H^+) = c\,V$

$= (0,0461) \times 0,075 \checkmark$

$= 3,4575 \times 10^{-3}$ mol

$n(H^+)_{initial} = c\,V \checkmark$

$= (0,1) \times (0,05) \checkmark$

$= 5 \times 10^{-3}$

$n(H^+)_{reacted\ with\ NaOH} = 5 \times 10^{-3} - 3,4575 \times 10^{-3}$ ✓✓

$n(NaOH) = 1,5425 \times 10^{-3}$ mol

$c(NaOH) = \frac{n}{V} \checkmark$

$= \frac{1,5425}{0,025} \checkmark$

$= 0,0617\ mol.dm^{-3}.$ ✓

[11]

TOTAL: 75