NATIONAL DEPARTMENT OF EDUCATION **SET B – MEMORANDUM**

PHYSICAL SCIENCE (SG) – PAPER 1 / *NATUUR -en SKEIKUNDE (SG) – VRAESTEL 1*

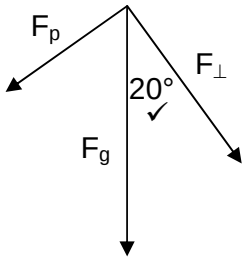
QUESTION 1 / *VRAAG 1*

1.1	D	1.2	C	1.3	A	1.4	C	1.5	A
1.6	B	1.7	D	1.8	D	1.9	A	1.10	B
1.11	C	1.12	C	1.13	B	1.14	A	1.15	D

[15 x 3 = 45]

QUESTION 2 / *VRAAG 2*

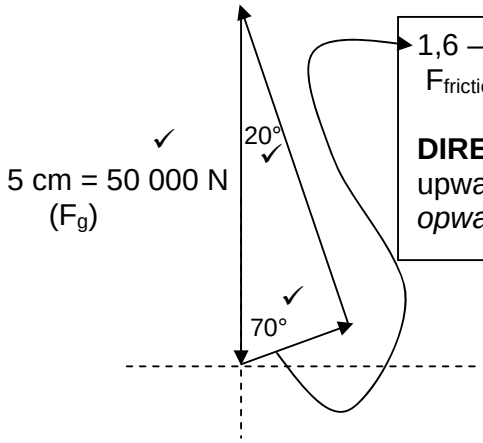
2.1



NOT W for weight
(If arrows missing : -1 max)
✓ orientation of 3 forces
✓ F_g : force of earth on truck / force of gravity / weight
✓ F_p : parallel component of weight
✓ $F_\perp$: perpendicular component of weight

(4)

2.2



1,6 – 1,8 cm = 16 000 – 18 000 N ✓
$F_{friction} = F_{parallel}$ (magnitude / grootte) ✓

DIRECTION / RIGTING : 20° to the horizontal, upwards to the right */ 20 ° met die horisontaal opwaarts na regs* (70° with vertical)

or calculation / *of berekening* :

$F_{friction} = F_{//}$ (in magnitude / *in grootte*)

$F_{//} = 50\,000.\ Cos\ 70°$ ✓✓ ✓ or $(50\,000.\ Sin\ 20°)$ ✓✓ ✓

= 17 101N. parallel and upwards along the plane / *parallel en opwaarts langs vlak* ✓

(5)

[9]

QUESTION 3 / *VRAAG 3*

3.1

$$s = ut + \frac{1}{2}at^2 \checkmark$$
$$20 = 0 + \frac{1}{2}(10)t^2 \quad \checkmark \checkmark \checkmark$$
$$t = \sqrt{4}$$
$$= 2\,s \checkmark$$

(5)

3.2

$$v^2 = u^2 + 2as \checkmark$$
$$= 0 + 2.10.20 \checkmark$$
$$v = \sqrt{400}$$
$$= 20\,m.s^{-1} \checkmark$$

$$v = u + at \checkmark$$
$$= 0 + (10)(2) \checkmark$$
$$= 20\ m.s^{-1} \checkmark \checkmark$$

(3)

3.3

$$s = vt \checkmark$$
$$= 4.2 \checkmark$$
$$= 8\,m \checkmark$$
$$8\,m < 12\,m$$

$$t = \frac{s}{v} \checkmark$$
$$= \frac{12}{4} \checkmark$$
$$= 3\ s \checkmark$$
$$3\ s > 2\ s$$

$$v = \frac{s}{t} = \frac{12}{2} \checkmark \checkmark$$
$$= 6\,m.s^{-1} \checkmark$$
$$6\,m.s^{-1} > 4\,m.s^{-1}$$

(3)

3.4

Distance left and time to accelerate:
s = 12 m ; t = 2 s.

$$s = ut + \frac{1}{2}at^2 \checkmark$$
$$12 = (4)(2) + \frac{1}{2}a(2)^2 \quad \checkmark \checkmark \checkmark$$
$$a = 2\,m.s^{-2} \checkmark$$

(5)

[16]

QUESTION 4 / *VRAAG 4*

4.1 A resultant force acting on a mass produces an acceleration in the direction of the force. The acceleration is directly proportional the resultant force and is inversely propotional to the mass.

As 'n resulterende krag op 'n massa inwerk versnel die massa in die rigting van krag. Die versnelling is direk eweredig aan die resulterende krag en omgekeerd eweredig aan die massa.

(3)

4.2

$F_{res} = ma$
$= 750 . 0.4$
$= 300 \text{ N}$

(4)

4.3

up +
$F_{res} = F_g + F_{applied}$
$ma = mg + F_{applied}$
$(750)(0,4) = 750x(-10) + F_{applied}$
$F_{applied} = 7\,800 \text{ N}$

down +
$F_{res} = F_g + F_{applied}$
$ma = mg + F_{applied}$
$(750)(-0,4) = 750x(10) + F_{applied}$
$F_{applied} = -7\,800 \text{ N}$
$= 7\,800 \text{ N}$ up

a & g opp. signs

(5)

4.4 Decreases / *Afneem* ✓✓

(2)

[14]

QUESTION 5 / *VRAAG 5*

5.1 ✓ ✓

In an isolated system, the sum of the gravitational potential energy and the kinetic energy remains constant. ✓

(3)

5.2 $E_p = mgh$ ✓

$= (2)(10)(1,5)$ ✓ ✓

$= 30\ J$ ✓

(4)

5.3 30 J ✓✓ (2)

5.4.1 Work done against friction / *Arbeid verrig teen wrywing* ✓✓ (2)

5.4.2 No / *Nee* ✓ (1)

[12]

QUESTION 6/ *VRAAG 6*

6.1 Conservation of Momentum

In an isolated system the total momentun remains a constant in magnitude and direction, **or**

In an isolated system the total momentum before impact is equal to the total momentum after impact.

In 'n geïsoleerde sisteem bly die linieêre momentum behoue in grootte en rigting

(4)

6.2

right +

$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

$0 = 0{,}025 \text{ x } v_1 + 0{,}4 \text{ x } 0{,}2$

$v_1 = -3{,}2 \text{ m.s}^{-1}$

$= 3{,}2 \text{ m.s}^{-1}$ left

OR

left +

$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

$0 = 0{,}025 \text{ x } v_1 + (0{,}4)(-0{,}2)$

$v_1 = +3{,}2 \text{ m.s}^{-1}$

(5)

6.3 left/ opposite direction of rolling cannon/ direction of ball. ✓✓ (2)

6.4 **right +ve**

$F_f = F_{res} = ma$

$= (0{,}4).(-0{,}05) = -0{,}02\text{N}$

$= 0{,}02\text{N}$ opposite to direction of motion / teenoorgestelde rigting van beweging

left +ve

$F_f = F_{res} = ma$

$= (0{,}4).(0{,}05)$

$= 0{,}02\text{N}$ opposite to direction of motion / teenoorgestelde rigting van beweging

(4)

[15]

QUESTION 7/ *VRAAG 7*

7.1

The force of attraction or repulsion which one charge exert on the other is directly proportional to the product of the charges ✓✓ and is inversely proportional to the square of the distance ✓✓ between them.

(4)

7.2

$$F = \frac{kQ_1Q_2}{r^2} \checkmark$$
$$= \frac{(9x10^9)(8x10^{-9})(4x10^{-9})}{(0,2)^2} \checkmark\checkmark \checkmark$$
$$= 7,2x10^{-6}\,N \checkmark, \text{towards X} \checkmark / \text{attraction / left}$$

(6)

7.3

$$E = \frac{kQ}{r^2} \checkmark$$
$$= \frac{(9x10^9)(4x10^{-9})}{(0,2)^2} \checkmark \checkmark$$
$$= 900\,N.C^{-1} \checkmark$$

$$E = \frac{F}{q} \checkmark$$
$$= \frac{7,2x10^{-6}}{8x10^{-9}} \checkmark \checkmark$$
$$= 900\ N.C^{-1} \checkmark$$

(4)

7.4

$$\text{New charge} = \frac{+8\,nC + (-4)nC}{2} \checkmark \checkmark$$
$$= \frac{+4nC}{2} \checkmark$$
$$= +2x10^{-9}\,C$$

(3)

[17]

QUESTION 8/ *VRAAG 8*

8.1 12 V ✓✓ (2)

8.2 12 V ✓✓ (2)

8.3.1 V_1 = 12 V✓ ; V_1 measures emf of battery / V_1 ✓✓ meet die emk van battery (3)

8.3.2 V_1 = 0 V✓ ; no resistance in conducting wire therefore no work done in moving charges / geen weerstand in geleier nie ✓✓ (3)

8.4

$$\frac{1}{R_p} \checkmark = \frac{1}{R_6} + \frac{1}{R_3}$$
$$= \frac{1}{6} \checkmark + \frac{1}{3} \checkmark$$
$$= \frac{1}{2}$$
$$R_p = 2\ \Omega \checkmark$$

$$R_p = \frac{\text{product}}{\text{sum}} \checkmark$$
$$= \frac{(6x3)}{(6+3)} \checkmark \checkmark$$
$$= 2\Omega \checkmark$$

(4)

8.5

$$I_{Cir} = \frac{V_{Cir}}{R_{Cir}} \checkmark$$
$$= \frac{12}{3} \checkmark \checkmark$$
$$= 4A \checkmark$$

+ 1 Ω

(4)

8.6

$$W = I^2Rt \checkmark \checkmark$$
$$= 4^2.1.90 \checkmark$$
$$= 1440\ J \checkmark$$

$$V_1 = IR = 4.1 = 4V$$
$$\therefore W = \frac{V^2}{R} t \checkmark \checkmark$$
$$= \frac{4^2.90}{1} \checkmark \checkmark$$
$$= 1440J \checkmark$$

$$W = VIt \checkmark$$
$$= 4.4.90 \checkmark \checkmark$$
$$= 1440J \checkmark$$

(4)

[22]

TOTAL : 150 : TOTAAL