LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES: PHYSICS (P1)
FISIESE WETENSKAPPE: FISIKA (Vr1)
PREPARATORY EXAMINATIONS
SEPTEMBER 2014
MEMORANDUM

This memorandum consists of 10 pages. / Hierdie memorandum bestaan uit 10 bladsye

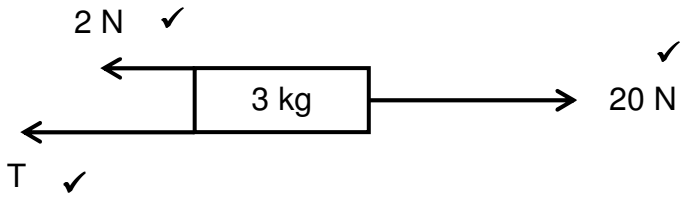
QUESTION/ Vraag 1

1.1 B✓✓ (2)
1.2 A✓✓ (2)
1.3 A✓✓ (2)
1.4 C✓✓ (2)
1.5 B✓✓ (2)
1.6 C✓✓ (2)
1.7 A✓✓ (2)
1.8 A✓✓ (2)
1.9 A✓✓ (2)
1.10 C✓✓ (2)
[20]

QUESTION/ Vraag 2

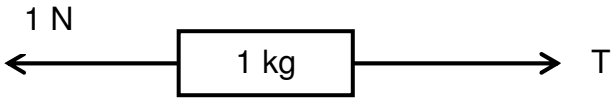
2.1 When a net force is applied to an object, the object accelerates in the direction of the net force. The acceleration is directly proportional to the (net) force and inversely proportional to the mass of the object. ✓✓ //
Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, versnel die voorwerp in die rigting van die krag teen 'n versnelling direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp. (2)

2.2



(3)

2.3 2.3.1 Consider the 1 kg block:



$F_{net} = ma = T + f$ ✓
$1a = T - 1$ ✓
$T = a + 1$ …….. equation/vergelyking 1

Consider the 3 kg block:
$F_R = ma = F_{applied} + T + F_f$
$3a = 20 - T - 2$ ✓ …….. equation/ vergelyking 2

Substituting for T:
$3a = 20 - (a + 1) - 2$ ✓
$4a = 17$
$a = 4{,}25\ m.s^{-2}$ ✓ (5)

OR/ OF

$F_{net} = ma$ ✓
$(F - f) = (M + m)\ a$
✓ ✓
✓
✓

$20 - (2 + 1) = 4a$

$a = 17/4 = 4{,}25\ ms^{-2}$ (5)

2.3.2 $T = a + 1 = 4{,}25 + 1 = 5{,}25\ N$ (2)

[12]

QUESTION/ VRAAG 3

3.1 8 m ✓ (1)

3.2 0,8 (s) ✓ (1)

3.3 (Take downward motion as NEGATIVE. (Other option: take downwards as positive))

$v_f = v_i + a\,\Delta t$ ✓

$0 = v_i + (-9{,}8)\ (0{,}4)$

$v_i = 3{,}92\ m{\cdot}s^{-1}$, up ✓ ✓ (3)

3.4

OPTION/OPSIE 1 + marking 3.3

$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓ ✓

$= (3{,}92)\ (0{,}4) + ½\ (-9{,}8)\ (0{,}4)^2$

$= 0{,}784$ m ✓

The maximum height = 8 + 0,78

= 8,78 m ✓

OPTION/OPSIE 2 + marking 3.3

$\Delta U + \Delta K = 0$

$½\ mv_i^2 + mgh_i = ½\ mv_f^2 + mgh_f$ } Any one ✓ ✓ ✓

$½xm(3{,}92)^2 + mx9{,}8x8 = 0 + mx9{,}8xh$

$h = 8{,}78$ m ✓

$(½xm(3{,}92)^2 + 0 = 0 + mx9{,}8xh$

$h = 0{,}78 \quad h_{tot} = 8{,}78$ m)

OPTION 3 + marking 3.3

$v_f^2 = v_i^2 + 2a\Delta y$

$(0)2 = (3{,}92)2 + 2\ (-9{,}8)\ \Delta y$ ✓

$\Delta y = 0{,}784$ m ✓

The maximum height = 8 + 0,78

= 8,78 m ✓

OPTION 4 + marking 3.3

$\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$ ✓

✓

$= ½\ (3{,}92 + 0)\ (0{,}4)$

$= 0{,}78$ m ✓

The maximum height = 8 + 0,78

= 8,78 m ✓

(4)

3.5 from maximum height downwards/ vanaf maksimum hoogte afwaarts

$v_f^2 = v_i^2 + 2a\Delta y$ ✓

$= (0)^2 + 2\ (-9{,}8)\ (-8{,}78)$ ✓

$v_f = 13{,}12\ m.s^{-1}$ ✓

+ marking from 3.4

OR / of

from the balcony upwards/ vanaf balkon opwaarts

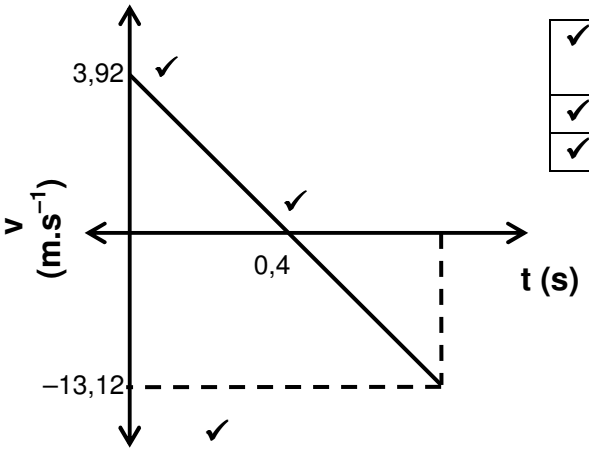
$v_f^2 = v_i^2 + 2a\Delta y$ ✓

$= (0)^2 + 2\ (-9,8)\ (-8)$ ✓

$v_f = 13,12\ m.s^{-1}$ ✓

(3)

3.6



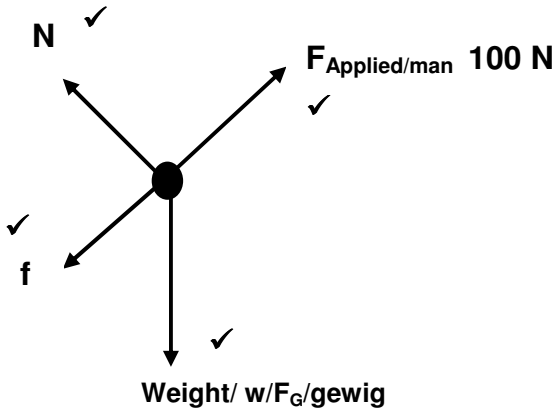
✓	Initial velocity/aanvanklike snelheid
✓	final velocity/finale snelheid
✓	Shape/vorm

(3)

[15]

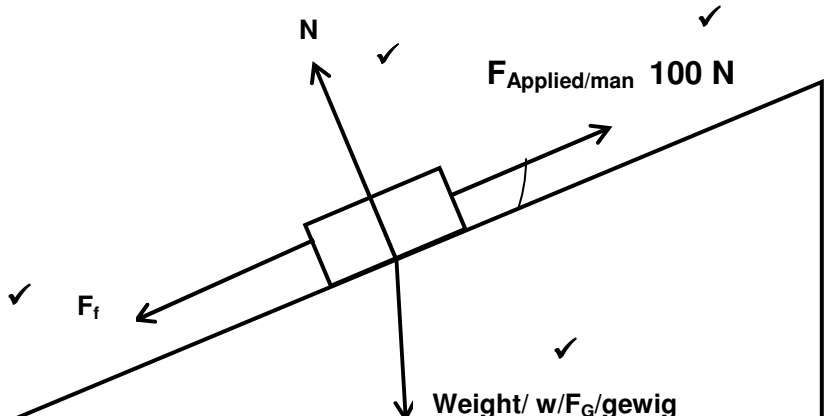
QUESTION/ VRAAG 4

4.1



(4)

OR/OF

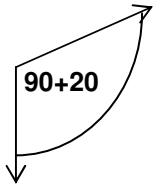


4.2 **OPTION 1**

Work Done by Gravity = $F \Delta x \cos\theta$ ✓

$W_G = (10 \times 9,8)(5) \cos 110^0$

$= -167,59$ J ✓



OPTION 2 ✓ ✓ ✓

Work done = $\Delta E_p = mgh - 0 = mg \Delta x \sin 20^0 = 10 \times 9.8 \times 5 \times \sin 20^0 = 167,59$ J

(3)

4.3.1 **OPTION 1**

$\Sigma F_y = 0$: $N + F_{G\perp} = 0$ ✓

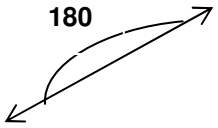
$F_N - mg \cos 20^0 = 0$

$F_N = (10)(9,8) \cos 20^0$ ✓

$= 92,1$ N

✓ ✓

$f_k = \mu F_N = (0,4)(92,1) = 36,8$ N



$\therefore$ Work Done by friction = $f_k \Delta x \cos\theta$

$W = (36,8)(5) \cos 180^0$ ✓

$= -184$ J ✓

OPTION 2

$F_k = \mu_k N$ ✓

$= 0,4\ mg \cos\theta$ ✓

$= 0,4 \times 10 \times 9,8 \cos 20^0$ ✓

$= 36,8$ ✓

$\therefore$ Work Done by friction = $f_k \Delta x \cos\theta$

$W = (36,8)(5) \cos 180^0$ ✓

$= -184$ J ✓

(6)

4..3.2 $W_F = F \Delta x \cos\theta = (100)(5) \cos 0^0 = 500$ N ✓ (1)

4.5 Work Energy theorem states that, the net/total work done on an object is equal to the change in the object's kinetic energy OR the work done on an object by a resultant/net force is equal to the change in the object's kinetic energy. ✓ ✓ (2)

4.6 $W_{NET} = \Delta E_K$ ✓ ✓ ✓ ✓

+ marking 4.2, 4.3.1, 4.3.2, 4.4

$$W_G + W_f + W_N + W_F = \tfrac{1}{2} mv_f^2 - \tfrac{1}{2} mv_i^2$$
$$(-168) + (-184) + (0) + (500) = \tfrac{1}{2} (10) v_f^2 - \tfrac{1}{2} (10) ((1,5)^2$$
$$v_f = 5,64 \text{ m.s}^{-1} \quad (4)$$

[20]

QUESTION/ VRAAG 5

5.1 Inelastic✓ Energy lost due to sound and heat or ✓
The two locomotives move together
Onelasties Lokomotiewe beweeg saam na die botsing (2)

5.2 **(take right a positive)**

$\Sigma p_{before} = \Sigma p_{after}$ ✓ [accept: $m_1v_i + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$ /$p_{before} = p_{after}$]

(6000)(4) ✓ + (5000) (v_B) ✓ = (6000 + 5000) (3) ✓
24000 + 5000 v_B = 33000
v_B = 1,8 m.s^{-1}✓ to the right✓ (6)

Other option: take right as negative

[8]

QUESTION/ VRAAG 6

6.1 Blood flow meter / Doppler flow meter ✓ / bloedvloeimeter/Dopplervloeimeter (1)

6.2 6.2.1 Higher pitch ✓/hoër toonhoogte (1)
6.2.2 Lower pitch ✓ / laer toonhoogte (1)

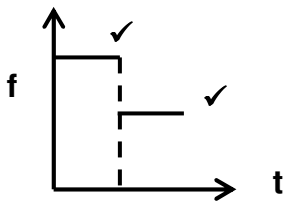
6.3 Use either $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓ or $f_L = \frac{v + v_L}{v} f_S$ ✓

✓

$f_L = \frac{330 + 30}{330 - 0}$ ✓ x 1800 ✓

f_L = 1 963,6 Hz ✓ (5)

6.4



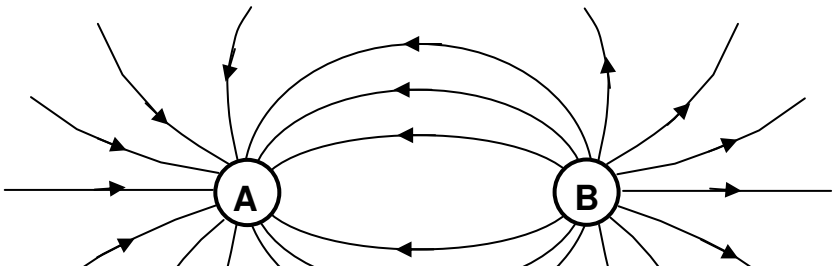
labels ✓

(3)
[11]

QUESTION/ VRAAG 7

7.1 Electric field at a point is the (electrostatic) force experienced per unit positive charge placed at that point. // Die elektriese veld by 'n punt is die elektrostatiese krag wat per eenheidspositiewe-lading wat by daardie punt geplaas is ondervind word (2)

7.2



Curved electric field line important. on outside

Geboë elektriese veld en lyne belangrik op buitekant

1 mark: shape of field between and outside 1 mark direction

(2)

7.3 $E_1 = \frac{kQ}{r^2}$ ✓

$= \frac{9 \times 10^9 (15 \times 10^{-9})}{(2 \times 10^{-2})^2}$ ✓✓

$= 337\ 500\ N.C^{-1}$ to the left/ links

$E_2 = \frac{kQ}{r^2}$

$= \frac{9 \times 10^9 (Q_x)}{(8 \times 10^{-2})^2}$ ✓

$= 1,40625 \times 10^{12} \times Q_x$ to the left / links

$E_{NET} = E_1 + E_2$

$3,943 \times 10^5$ ✓$= 337\ 500 + 1,40625 \times 10^{12} Q_X$ ✓

$Q_X = +4,04 \times 10^{-8}$ C✓ (7)

7.4 decrease / ✓ afneem (1)

[12]

QUESTION/VRAAG 8

8.1 $P = \frac{V^2}{R}$ ✓

$13,5 = \frac{(18)^2}{R}$ ✓

$R = 24\ \Omega$ ✓

OR $P = VI$ ✓

$I_R = P/V = 13,5/18 = 0,75$ A ✓

$V = IR$

$R = V/I_R = 18/0,75 = 24\ \Omega$ ✓ (3)

8.2

$$R = \frac{V}{I} \checkmark$$

$$24 = \frac{18}{I} \checkmark$$

$$I = 0{,}75 \text{ A}$$

$$R = \frac{V_p}{I_{12}}$$

$$12 = \frac{18}{I_{12}} \checkmark$$

$$I_{12} = 1{,}5 \text{ A} \checkmark$$

$\checkmark$

$I_{Total} = 1{,}5 + 0{,}75 = 2{,}25 \text{ A} = I_{10\,\Omega}$ (5)

OR

$$\frac{1}{R_p} = \frac{1}{r_1} + \frac{1}{r_2} \checkmark$$

$$\frac{1}{R_P} = \frac{1}{12} + \frac{1}{24} \checkmark$$

$R_P = 8\Omega$ ✓

$V = IR_P$

$18 = I\,(8)$ ✓

$I = 2{,}25$ A ✓ (5)

$\checkmark$

8.3 Internal resistance is the opposition to the follow of charge within a cell (or an ammeter) ✓/ Interne weerstand is die teenstand teen die vloei van stroom binne-in 'n sel (of 'n ammeter) (2)

8.4 When the switch is closed, the pd across the 10 Ω resistor is

$V_{10} = IR_{10}$ ✓ $= 2{,}25 \times 10$ ✓ $= 22{,}5$ V ✓ (3)

8.5 The pd across the external resistors is given by:

$V_1 = V_{ext} = V_P + V_{10} = 18 + 22{,}5 = 40{,}5$ V ✓

When the switch is open the total pd (emf) is: Emf = V_{total} = 45,9 V

∴ The 'lost volts' is: $V_L = V_{Total} - V_{ext} = 45{,}9 - 40{,}5 = 5{,}4$ V ✓

$$r = \frac{V_L}{I} \checkmark$$

$$= \frac{5{,}4}{2{,}25} \checkmark$$

$= 2{,}4\ \Omega$ ✓ (5)

OR $V_{TOT} = E = I_{TOT}(R_{ext} + R_{int})$ ✓

45,9 ✓ $= (2,25)(R_P + 10 + r)$

$= (2,25)(8 + 10 + r)$ ✓

$r = 2,4\ \Omega$ ✓

$\frac{1}{R_p} = \frac{1}{r_1} + \frac{1}{r_2}$

$\frac{1}{R_P} = \frac{1}{12} + \frac{1}{24}$

$R_P = 8\Omega$ ✓

8.6 Increase / Toeneem (1)

[19]

QUESTION/ VRAAG 9

9.1 Ohm's Law states that: the potential difference across a conductor is directly proportional to the current in the conductor at constant temperature./ Die potensiaalverskil oor 'n geleier is direk eweredig aan die stroom in die geleier by konstante temperatuur (2)

9.3 Inverse of resistance or 1/R ✓ / omgekeerde van weerstand (1)

9.2 Y ✓ The inverse of the gradient of graph Y is greater ✓

Gradient of graph Y smaller. Thus 1/R smaller. Hence, R is greater. ✓

Y; Y se gradient kleiner dus is die omgekeerde van R kleiner, dus R groter (2)

9.4 R_X can be found by finding the gradient of the graph for X

$\text{gradient} = \frac{\Delta I}{\Delta V}$

$m = \frac{0,4 - 0,2}{8 - 4}$ ✓ ✓ (or other correct values from graph) (of ander korrekte waardes vanaf grafiek)

$= 0,05$

$Rx = \frac{1}{0,05}$ ✓

$= 20\ \Omega$ ✓ (4)

[9]

QUESTION/VRAAG 10

10.1 Mechanical energy is converted to electrical energy. ✓/ meganiese energie na elektriese energie (1)

10.2 10.2.1 AC generator ✓/ WS generator (1)

10.2.2 3 ✓ (slip rings/ sleepringe) (1)

10.2.3 anti-clockwise ✓/ anti-kloksgewys (1)

10.2.4 The (rate of) change in magnetic flux/ magnetic field linkage is at a maximum ✓ // die tempo van verandering van magnetise fluks is maksimum

. (2)

10.3 $V_{rms} = \frac{V_{max}}{\sqrt{2}} = \frac{330}{\sqrt{2}}$ ✓

= 233,36 V

$P_{rms} = V_{rms}I_{rms}$ ✓

= 233,36 x 15 ✓

= 3500,25 W ✓ (5)

[11]

QUESTION/VRAAG 11

11.1 Cathode ✓ / katode (1)

11.2 Threshold frequency ✓ /dumpelfrekwensie ✓ (1)

11.3 Work function is the minimum quantity of energy which is required to remove an electron from the surface of a given solid, usually a metal. ✓
die minimum energie benodig om 'n elektron uit die oppervlak van 'n metaal vry te stel. (2)

11.4 $E = W_0 = h f_0$ ✓

$= (6{,}63 \times 10^{-34})(5 \times 10^{14})$ ✓

$= 3{,}315 \times 10^{-19}$ J ✓ (3)

11.5 $hf = W_0 + \frac{1}{2}mv^2$ ✓

$(6{,}63 \times 10^{-34})(f_1) = 3{,}315 \times 10^{-19} + 11 \times 10^{-19}$ ✓ ✓ ✓

$f_1 = 2{,}15 \times 10^{15}$ Hz ✓ (5)

11.6 same ✓/ dieselfde (1)

[13]

Grand total: 150