Hillcrest High School

PHYSICAL SCIENCE P1 memo

Nov 2023

Grade 11

MARKS: 100

TIME: 2 Hours

EXAMINER: Ms N. Badenhorst

MODERATOR: Mrs J. Knox-Whitehead

1.1 D

1.2 A

1.3 A

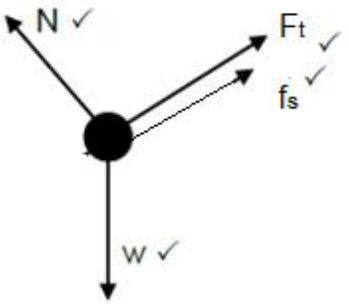
1.4 A

1.5 A

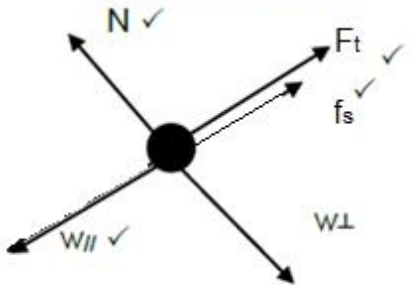
Question 2 – Newton

2.1 A body will remain in its state of rest or motion at constant velocity unless a non-zero resultant/net/unbalanced force acts on it. ✓✓

2.2



Accept/*Aanvaar*



(4)

2.3

$F = (Fg_{//})_{5kg} + (Fg_{//})_{3kg} - f_s$

$= \underline{5(9,8)\sin 30° + 3(9,8)\sin 30°}\checkmark \underline{- 16,97}\checkmark = 22,23\ N\checkmark$

(3)

2.4

Marking criteria/*Nasienkriteria*:

- Formula for block P or block Q ✓
- Substitution of Fnet for block P ✓
- Substitusion of Fnet for block Q ✓
- 5a OR 3a ✓
- Answer: $a=5,16\ m\cdot s^{-2}$ ✓

For Block P:

$F_{net} = ma$

$T + (-F_{g//}) + (-f) = ma$ } Any one ✓

$\underline{T - (5\times 9,8)\sin 30° - 4,5}\checkmark = \underline{5a}\checkmark$

$T = 5a + 29$

For Block Q:

$F_{net} = ma$

$F + (-F_{g//}) + (-T) = ma$

$\underline{85 - (3\times 9,8)\sin 30° - T}\checkmark = 3a$

$T = 70,3 - 3a$

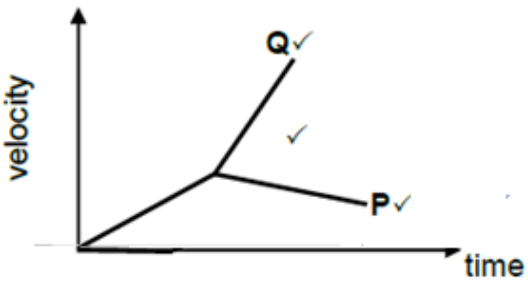
$\therefore 5a + 29 = 70,3 - 3a$

$8a = 41,3$

$a = 5,16\ m\cdot s^{-2}\checkmark$

(5)

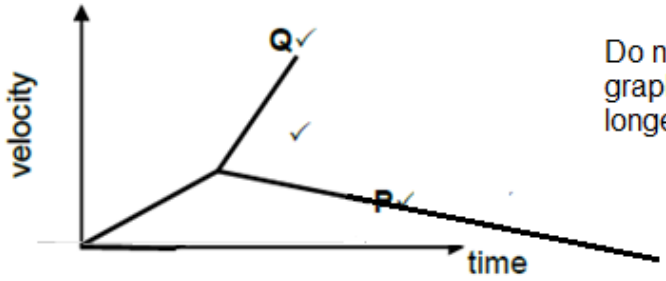
2.5



Marking criteria/*Nasienkriteria*

- Both straight lines✓
- For Q: positive gradient and larger than initially✓
- For P: negative gradient✓

(3)
[17]



Do not penalise if graphs continue for longer

Question 3

3.1

Marking criteria
-1 mark for each key word/phrase omitted in the correct context.

Each body in the universe attracts every other body with a (gravitational) force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers. ✓✓

OR:

Every particle in the universe attracts every other particle with a (gravitational) force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them. ✓✓ (2)

3.2.1

$g_E = \frac{GM_E}{R_E^2} = 9{,}8\ m\,s^{-2}$

$g_M = \frac{GM_M}{R_M^2}$ ✓

$= \frac{G\left(\frac{M_E}{153}\right)}{\left(\frac{R_E}{5}\right)^2}$ ✓

$= \frac{25}{153}\ \frac{GM_E}{R_E^2}$

$= \frac{25}{153}\ (9{,}8)$

$= 1{,}60\ m\,s^{-2}$ ✓ (downwards)

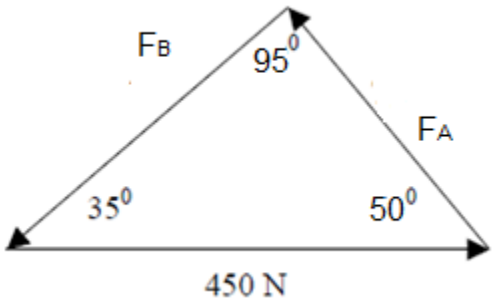
Careful: the information is given from the perspective of the earth. However it is asked from the perspective of the other planet.

(3)

3.2.2 Equal to ✓ (1)

Question 4 – Vectors

4.1



4.2

$$\frac{\sin 95}{450} = \frac{\sin 35}{A}$$

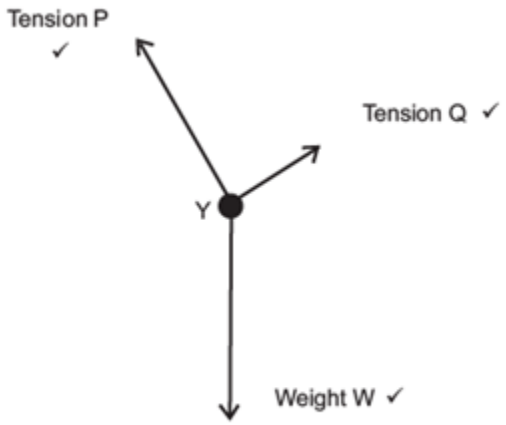
FA = 259,1 N

$$\frac{\sin 95}{450} = \frac{\sin 50}{B}$$

FB = 346,04 N

Question 5

5.1

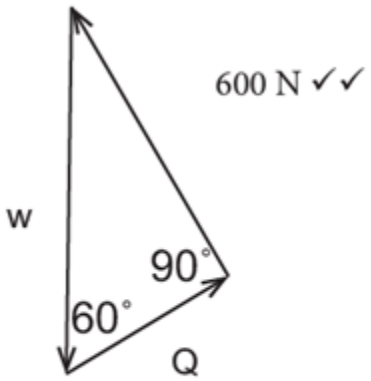


-1 if no key

(3)

5.2 Yes✓ Point Y remains at rest therefore the net force acting on point Y is zero✓ (2)

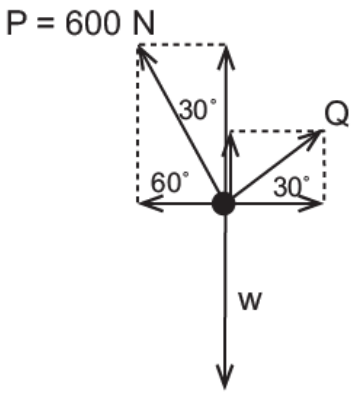
5.3 Triangle of forces method:



$\tan 30° = \frac{Q}{600}$✓

$Q = 600 \tan 30° = 346,41$ N✓ (4)

OR Components method:



$P_x = P\cos 60° = (600)\cos 60°$✓$= 300$ N✓

$P_x = Q_x$✓$= Q\cos 30°$

$300 = Q\cos 30°$

$Q = 346,41$ N✓ (4)

.

5.4 Learners must realise string P will break first, since it is the side opposite the largest angle.

Sin 60 = $\frac{600}{Fg}$ or Cos 30 = $\frac{600}{Fg}$

Fg = 692,8203 N

Fg = m.g

692,8203 = m (9,8)

m = 70,7 kg

Question 6 – circuits

6.1.1 Is the maximum energy provided by a battery per unit charge passing through it. ✓✓

6.2.1 $\frac{1}{Rp} = \frac{1}{R1} + \frac{1}{R2+3}$ ✓

$\frac{1}{Rp} = \frac{1}{4} + \frac{1}{2+6}$ ✓

$\frac{1}{Rp}$ = 3/8

Rp = 8/3Ω

Rt = Rp + Rs

= 8/3 + 3

= 5,67 Ω✓

6.1.2

Emf = I(R + r) ✓

12 = I (5,67 + 1) ✓

I = 1,799 A

$V_p = I_T.R_p$✓

= 1,799 (2,67) ✓

= 4,8033 V✓

6.2.3

$I = \frac{V}{R} = \frac{4,80}{4} = 1,20\ A$

$W = I^2R\Delta t$ ✓
$= 1,2^2 \cdot 4 \cdot 120$ ✓
$= 691,20\ J$ ✓

or/of

$W = VI\Delta t$ ✓
$= 4,80 \cdot 1,2 \cdot 120$ ✓
$= 691,20\ J$ ✓

(3)

Question 7 – Ohm's law

7.1.1 emf (ε) = $IR_{ext} + Ir$ ✓

When the current increases, Ir (lost volts) increases ✓

emf (ε) is the same /constant ✓

∴ IR_{ext} (terminal voltage/pd)(voltage of the load) decreases (3)

7.1.2 Group 2 ✓ (1)

7.1.3

gradient = $-\frac{\Delta V}{\Delta I}$ ✓

gradient = $-\frac{4-12}{4-0}$ ✓

= 2 Ω ✓

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

gradient = $\frac{4-12}{4-0}$ ✓

= - 2 Ω

-r = - 2 Ω

r = 2 Ω ✓

(3)

Question 8 – electrostatics

8.1 The magnitude of the electrostatic force exerted by one point charge (Q_1) on another point charge (Q_2) is directly proportional to the product of the magnitudes of their charges✓ and inversely proportional to the square of the distance (r) between them ✓

8.2 $$F = \frac{kQ_1Q_2}{r^2}$$

'F' at 'C' due to A

$$F_{CA} = \frac{(9{,}0 \times 10^{9})(4 \times 10^{-6})(8 \times 10^{-6})}{0{,}5^2}$$ ✓

= 1,152 N to the right / *na regs*

'F' at 'C' due to B

$$F_{CB} = \frac{(9{,}0 \times 10^{9})(4 \times 10^{-6})(3 \times 10^{-6})}{0{,}2^2}$$ ✓

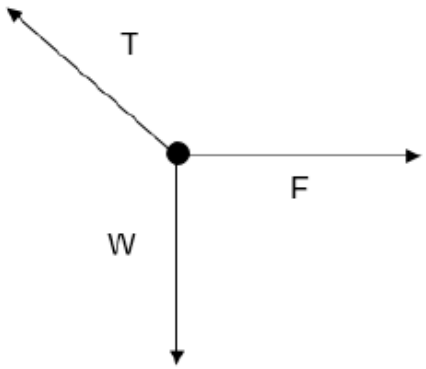
= 2,7 N to the left / *na links* ✓

(4)

Net electrostatic force at C = 2,7 - 1,152

= 1,55 N to the left ✓

8.3.1



8.4.1 Forces are in equilibrium / *Kragte is in ewewig*

$w = mg$

$= (0{,}0009)(9{,}8)$ ✓

$= 0{,}0088$ N

$\tan 45^\circ = \frac{(F)}{(0{,}0088)}$ ✓

$= 0{,}008$ N repulsion to the right. / *afstotend na regs*✓ (3)

8.4.2 **POSITIVE MARKING FROM QUESTION** 8.4.1

$F = \frac{kQ_1Q_2}{r^2}$ ✓

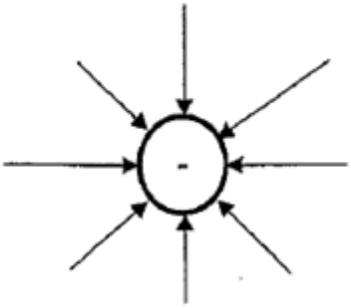
$0{,}0088 = \frac{(9 \times 10^9)(Q)^2}{(0{,}04)^2}$ ✓

$Q = 3{,}8 \times 10^{-8}$ C ✓ Accept the range 3,8 to 3,9 $\times 10^{-8}$ C (3)

Question 9

9.1 Negative/*Negatief* (1)

9.2



Negative	✓
Arrow direction	✓
Arrows touching charge	✓

(3)

9.3 A region of space in which an electric charge experiences a force✓✓
I'n Gebied in die ruimte waarin 'n elektriese lading 'n krag ondervind. ✓✓ (2)

9.4 $E_{Net} = E_V + E_w$✓

2×10^{-2}✓ $= \frac{9,0 \times 10^9 \cdot Q}{0,02^2}$ ✓+ $\frac{9,0 \times 10^9 \cdot Q}{0,03^2}$ ✓ $(Q_V = Q_W)$

$Q = \underline{6.15 \times 10^{-16}\ C}$✓

(5)
[11]