POSSIBLE ANSWERS FOR:

PHYSICAL SCIENCE PAPER 1 HG / NATUUR- en SKEIKUNDE VRAESTEL 1 HG

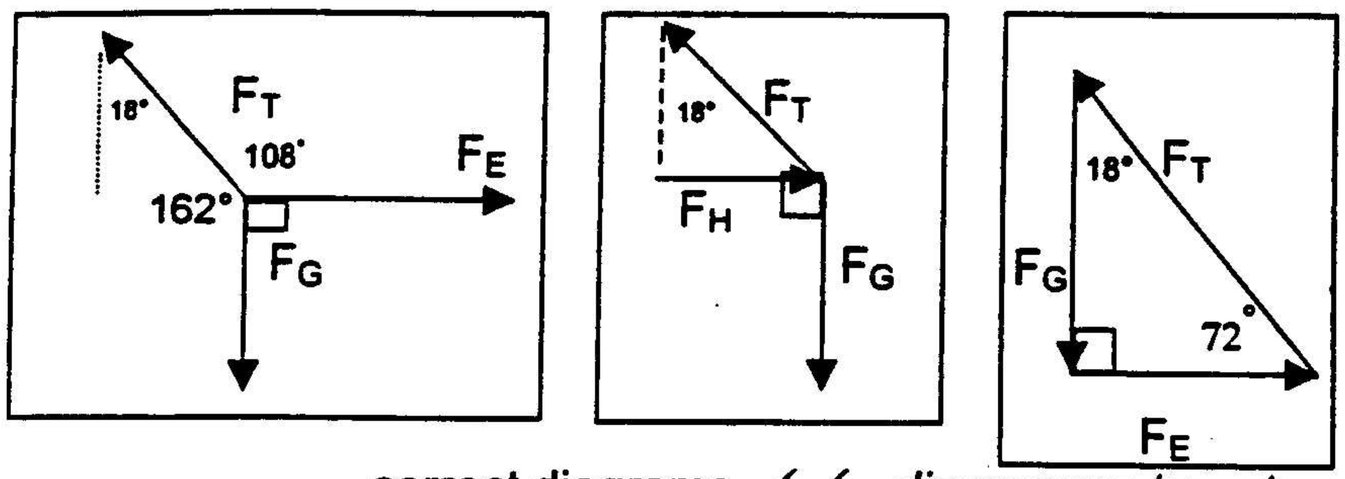
QUESTION 1 /*VRAAG 1*

1.1 B	1.2 C	1.3 A	1.4 C	1.5 A	1.6 C	1.7 B
1.8 A	1.9 D	1.10 C	1.11 D	1.12 B	1.13 A	1.14 B
1.15 D						[15 X 4 = 60]

QUESTION 2 / *VRAAG 2*

A. MARK ANY WORK THAT HAS BEEN CROSSED OUT
B. CONSIDER ALL ATTEMPTS – MARK THE "BEST" ATTEMPT.

2.1



correct diagrams ✓✓ *diagramme korrek*
correct labels ✓ *korrekte byskrifte*
any two **correct** angles ✓ *enige twee **korrekte** hoeke*
angles correctly placed opposite correct forces / hoeke korrek teenoor korrekte krag geplaas (4)

- F,T,w,F_H – accepted
- Arrows in middle of vector accepted
- NO arrows : Deduct 2 marks

2.2 $F_G = mg = 4 \times 10^{-3}.10 = 4 \times 10^{-2}$ N ✓✓

$F_E = F_G.\tan 18°$ ✓
✓
$= 4 \times 10^{-2}.\tan 18°$ ✓
$= 1,3 \times 10^{-2}$ N

OR

$F_E = F_G / \tan 72°$ ✓
✓
$F_E = 0,04 / \tan 72°$ ✓
$= 1,3 \times 10^{-2}$ N

OR

sine rule / sinus
reël ✓✓✓

(5)

2.3

$E = {}^{F}/_{q} = \frac{1,17 \times 10^{-2}}{3,5 \times 10^{-6}}$ ✓ ✓ ✓ $= 3343$ N.C^{-1} ✓ $(3,3.10^{3})$(V.m^{-1})	$E = {}^{F}/_{q} = \frac{1,3 \times 10^{-2}}{3,5 \times 10^{-6}}$ ✓ ✓ $= 3714$ N.C^{-1} ✓ (V.m^{-1})

(4)

2.4 the same as / *dieselfde as* ✓ ✓✓
uniform (constant) field strength between the plates / *uniforme (konstante)veldsterkte tussen die plate* / (force is constant / *krag is konstant)* (3)

[16]

QUESTION 3 / *VRAAG 3*

3.1

$$a = \frac{v - u}{t} = \frac{8 - 0}{2} = 4\ m.s^{-2}$$ ✓✓✓

{ DO NOT accept : $a = \frac{v}{t}$ }

Or/Of

$$a = \frac{\Delta v}{\Delta t} = \frac{8}{2} = 4\ m.s^{-2}$$ ✓✓✓

0 need not be shown
0 hoef nie getoon te word nie (3)

3.2

$v = u + at$ ✓✓✓
$= 0 + 4.4$
$= 16\ m.s^{-1}$ ✓

OR

$a = \frac{\Delta v}{\Delta t}$ ✓
$4 = \frac{v - 8}{4 - 2}$ ✓
$8 = v - 8$
$v = 16\ m.s^{-1}$ ✓

(4)

3.3

$v_6 = 0\ m.s^{-1}$ ✓✓

NO unit : -1 zero : 1 mark allocated
(POSITIVE MARKING / POSITIEF MERK)

(2)

3.4

$v = u + at$ ✓
$0 = 16 + a.2$ ✓✓
$a = -8\ m.s^{-2}$ ✓

OR / OF

$a = \frac{\Delta v}{\Delta t} = \frac{0 - 16}{6 - 4} = -8\ m.s^{-2}$ ✓✓✓✓

(4)
[13]

QUESTION 4 / *VRAAG 4*

4.1

$v = u + at$ ✓

✓ ✓

$0 = 80 + (-5).t$

$t = 16\ s$ ✓

(4)

4.2 $s_{2s} = 80.2 = 160\ m$ ✓✓

$s_{16s} = ut + \frac{1}{2}at^2$ ✓

✓ ✓

$= 80.16 + \frac{1}{2}.(-5).16^2$

$= 1280 - 640$

$= 640\ m$ ✓

$v^2 = u^2 + 2as$ ✓

✓ ✓

$0 = 80^2 + 2.(-5).s$

$s = 640\ m$ ✓

$s = \left(\frac{u+v}{2}\right)t$ ✓

✓

$= \left(\frac{80+0}{2}\right).16$ ✓

$= 640\ m$ ✓

remaining / oorblywend = 1500 - (160 + 640 + 100) ✓

= 600 m ✓

If S_{2s} = 160 m omitted then

remaining = 760 m ($\frac{6}{8}$)

OR / OF

Take end as beginning of runway / neem end as begin van aanloopbaan

Accept also : 100 + 640 + 160 = 900 m ✓

Aanvaar ook : OR S remaining = 740 m

(8)

4.3 $F = ma$ ✓

✓ OR / OF : (1200)(5) = 6000 N

$= 1200.(-5)$

$= -6000\ N$ ✓ ; opposite to direction of motion ✓ / in teenoorgestelde rigting

$= 6000\ N$ opposite to direction of motion / van beweging

OR / OF

$W = \Delta E_K = \frac{1}{2}(1200)(80^2) - 0$

$= 3{,}84 \times 10^6\ J$ ✓

$W = F \times s$ ✓

$3{,}84 \times 10^6\ J = F \times 640$ ✓

$F = 6000\ N$; ✓ opposite to direction of motion / in teenoorgestelde rigting van beweging

$F = \frac{\Delta p}{\Delta t}$ ✓ ✓

$= \frac{0 - (1200)(80)}{16}$

✓

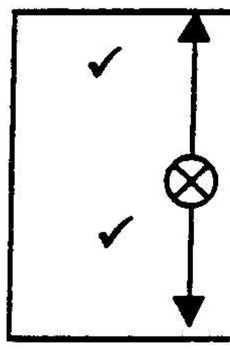
$= 6000\ N$ *in opposite direction of motion* ✓

(4)

[16]

QUESTION 5 / *VRAAG 5*

5.1



✓ F_a (accelerating force / tension in cable / applied force) ✓
spanning in kabel / versnellingskrag / toegepaste krag

✓ F_G (weight of cage or gravitational force) ✓
gewig van hok of gravitasiekrag

OR / OF

✓ Cage on passenger / hok op passasier ✓

✓ Passenger on cage / passasier op hok ✓

- 3 arrows + labels : 4marks
- 3 arrows + NO labels : $\frac{1}{4}$
- **ONLY 3 rd accepted force : friction**

(4)

5.2

$F_{res} = 7950 - mg$
$= 7950 - 750.10$
$= 450\ N$ ✓

POSITIVE MARKING

$a = \frac{F_R}{m}$ ✓
$= \frac{450}{750}$ ✓
$= 0{,}6\ m.s^{-2}$ ✓

NOTE !

$a = \frac{F}{m} = \frac{7950}{750}$

max : $\frac{2}{5}$

OR /OF

$F = ma$ ✓ ✓
$7950 = 750.a$
$a = 10{,}6\ m.s^{-2}$ ✓

If no further calculation than 10,6 : max $\frac{2}{5}$

$a_{RES} = 10{,}6 - 10 = 0{,}6\ m.s^{-2}$ ✓

(5)

5.3 Newton 2 ✓

the **resultant force** acting on a body produces an acceleration in its direction. The magnitude of the acceleration is directly proportional to the **resultant force** and inversely proportional to its mass. (unbalanced force and indirectly proportional **NOT** accepted)

*Die **resulterende krag** wat op 'n liggaam inwerk, gee aan dit 'n versnelling in die rigting van die krag.*

*Die grootte van die versnelling is direk eweredig aan die grootte van die **resulterende krag** en omgekeerd eweredig aan sy massa. ✓(ongebalanseerde krag en indirek eweredig is **NIE** aanvaarbaar nie)*

The resultant force acting on a body is directly proportional to the rate of change of momentum in the direction of the force ✓

Die resulterende krag wat op 'n liggaam inwerk is direk eweredig aan die tempo van verandering in momentum in die rigting van die krag.✓

(4)

5.4

Accept the following options / *Aanvaar die volgende moontlikhede* !

Upwards /opwaarts ✓ $F_T > F_G$ ✓✓✓	Downwards/afwaarts✓ $F_G > F_T$ ✓✓✓	Downwards/afwaarts✓ $F_T > F_G$ ✗	Upwards / opwaarts✓ $F_G > F_T$ ✗

(4)
[17]

QUESTION 6 / *VRAAG 6*

6.1 The force of attraction between any two particles in the universe is directly proportional to the product of their masses ✓✓and inversely proportional to the square of the distance separating them.✓✓

/ *Die aantrekkingskrag tussen enige twee deeltjies in die heelal, is direk eweredig aan die produk van hulle massas✓✓ en omgekeerd eweredig aan die kwadraat (vierkant) van die afstand tussen hulle.✓✓*

(4)

6.2 $mg = G\frac{m.M}{r^2}$ ✓✓ { 2 OR 0 } $w = G\frac{m.M}{r^2}$ no marks (2)

6.3 $g = G\frac{M}{r^2} \Rightarrow 3,8 \checkmark = \frac{6,7 \times 10^{-11}.6,4 \times 10^{23}}{r^2}$ ✓ ✓

$\Rightarrow r^2 = 1,128 \times 10^{13}$

$r = 3,36 \times 10^6$ m✓ OR / OF $(3,4 \times 10^6$ m) (4)

[10]

QUESTION 7 / *VRAAG 7*

7.1 p(before/voor) = p(after/ na) } ✓ (any one of the two)

$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

✓ ✓ ✓

$4000.1,5 + 0 = 4000.v_1 + 3000.2,8$

$v_1 = -0,6$ m.s^{-1}

= 0,6 m.s^{-1} ✓due west / *reg wes* ✓*(backwards / left)*

(na agter / links) (6)

7.2 Law of conservation of momentum / *Wet van behoud van momentum* ✓

✓ ✓ ✓

The total **or** linear momentum of a closed system remains constant in magnitude and direction /

✓ ✓ ✓

*Die totale **of** liniêre momentum van 'n geïsoleerde stelsel bly konstant in grootte en rigting.*

OR / OF

✓ ✓ ✓

The total linear momentum of a closed system is conserved

✓ ✓ ✓

Die totale liniêre momentum van 'n geïsoleerde stelsel bly behoue.

4

OR / OF (next page / volgende bladsy)

The total momentum before collision is equal to the total momentum after collision, if there are no external forces acting on the system (closed / isolated). / *Die totale momentum voor botsing is gelyk aan die totale momentum na botsing indien daar geen eksterne kragte op die stelsel inwerk nie(geslote / geïsoleerde)* ✓

IF / As $p_{before} = p_{after}$: max $\left(\frac{1}{3}\right)$ (4)

[10]

QUESTION 8 / *VRAAG 8*

8.1

of / or $F_{RES} = 0$ N
of / or $F_g = F_{air\ resistance}$ ✓✓ (2)

8.2

$E_P = mgh$
$= 120.10.450$
$= 5{,}4 \times 10^5$ J ✓

OR/OF

$E_P = W$ ✓
$= F.s$
$= 1200.450$
$= 5{,}4 \times 10^5$ J ✓

$W = F.s$
$= 1200.450$
$= 5{,}4 \times 10^5$ J ✓

max $\left(\frac{3}{4}\right)$ (4)

8.3 $E_K = \frac{1}{2}mv^2 = \frac{1}{2}.120.30^2 = 5{,}4 \times 10^4$ J ✓ (3)

8.4 $W = (5{,}4 \times 10^5 - 5{,}4 \times 10^4) = 4{,}86 \times 10^5$ J ✓ (3)

8.5

W = ΔE_K = F.s
F = W/s ✓
$\frac{5,4 \times 10^4}{1,5}$ ✓
= 3,6 x 10^4 N ✓

against the displacement / ✓
teen die rigting van die verplasing
upwards / *opwaarts*

OR

$v^2 = u^2 + 2as$
$0 = 30^2 + 2a(1,5)$ ✓
$a = -300\ m.s^{-2}$

$F = ma$ ✓
$= 120(-300)$ ✓
$= -36000\ N$
$= 36000\ N$ *upwards / opwaarts* ✓

OR / OF

$s = \left(\frac{u+v}{2}\right)t$ ✓
$1,5 = \left(\frac{30+0}{2}\right)t$
$t = 0,1\ s$ ✓

$F\Delta t = m(v-u)$ ✓
$F(0,1) = 120(0-30)$
$= -36000\ N$ ✓
$= 36000\ N$ *upwards / opwaarts* ✓

v = u + at ✓
$0 = 30 + a(0,1)$
$a = -300\ m.s^{-2}$ ✓

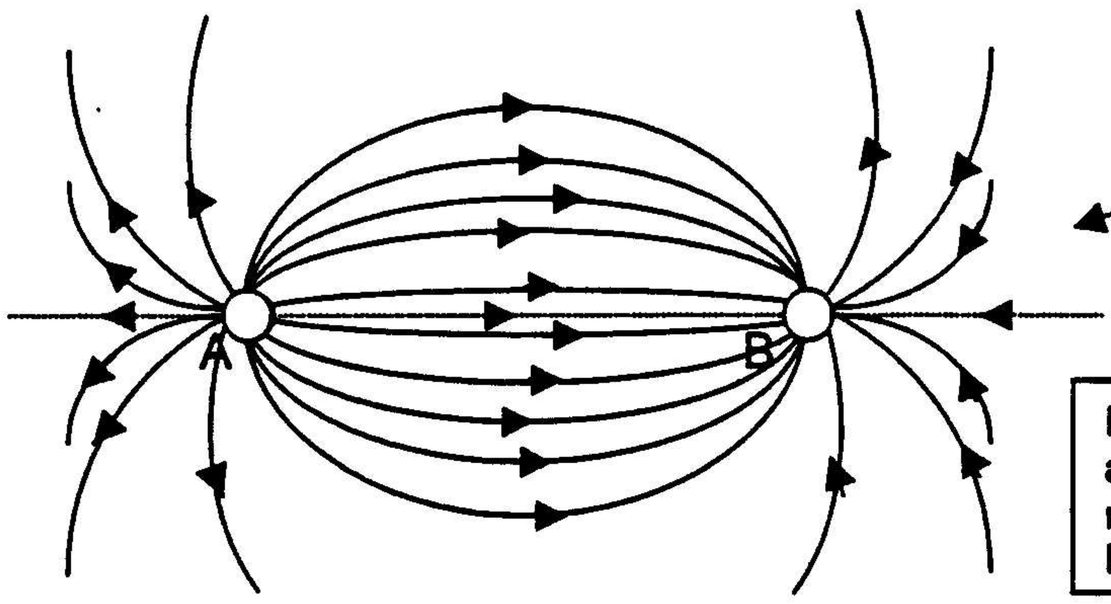
F = ma ✓
= (120) (-300)
= - 36000 N ✓
= 36000 N upwards / opwaarts ✓
(3,6 x 10^4 N)

(5)

[17]

QUESTION 9 / *VRAAG 9*

9.1



shape between ✓ *tussen*
shape outside ✓ *buitekant*
directions inside ✓ *rigtings*
directions outside ✓ rigitngs

Note – the charge density is higher at the negative charge which will result in a greater field density at B. NOT necessary to indicate !!!

(4)

9.2

$$E = k\frac{Q}{r^2} \quad \checkmark \quad \checkmark \quad \checkmark$$

$$1{,}2 \times 10^6 = \frac{9 \times 10^9 . 6 \times 10^{-6}}{r^2} \quad \checkmark$$

$$r^2 = 4{,}49 \times 10^{-2}$$

$$r = 0{,}21 \text{ m} \checkmark$$

If $Q = 12 \times 10^{-6}$ C then
r = 0,3 m
max : $\frac{3}{5}$

OR/OF

$$F = Eq = (1{,}2 \times 10^6)(12 \times 10^{-6})$$
$$= 14{,}4 \text{ N}$$

$$F = k\frac{Qq}{r^2} \quad \checkmark\checkmark$$

$$r^2 = \frac{9 \times 10^9 \times 6 \times 10^{-6} \times 12 \times 10^{-6}}{14{,}4} \quad \checkmark\checkmark$$

$$= 0{,}045$$

$$r = 0{,}21\ m \checkmark$$

(5)

9.3.1 non-uniform / *nie-uniform* ✓✓

If 9.3.1 is wrong then do not allocate marks for 9.3.2

✓✓

9.3.2 radial field not constant in field strength / *radiale veld nie konstant in veldsterkte.*
non - uniform field / *nie - uniforme veld*
non – uniform force / *nie – uniforme krag*
force varies / *krag varieer*
non – uniform acceleration / *nie – uniforme versnelling* (4)
[13]

QUESTION 10 /VRAAG 10

10.1

$\frac{1}{R}$ ✓ = $\frac{1}{r_1} + \frac{1}{r_2}$
= $^1/_6 + ^1/_6$ ✓
= $^1/_3$
R = 3 Ω ✓
R_{tot} = (3 + 2) = 5 Ω ✓

$\frac{1}{R_P} = \frac{1}{6} + \frac{1}{6}$ ✓
$= \frac{2}{6}$
$= \frac{6}{2}$ max: $\frac{3}{4}$
$= 3\Omega$
$R_{TOTAL} = 3 + 2 = 5\Omega$ ✓ ✓

$R_P = \frac{product}{sum}$
$= \frac{6 \times 6}{6 + 6}$
$= 3\Omega$ ✓✓
$R_{TOTAL} = 3 + 2 = 5\Omega$ ✓ ✓

$R_P = \frac{1}{6} + \frac{1}{6}$
$= 3\Omega$ max: $\frac{2}{4}$
$R_{TOTAL} = 3 + 2$
$= 5\Omega$ ✓✓

R_P = 3 Ω ✓✓

R_{TOT} = 5 Ω ✓✓

(4)

10.2

I = $^V/_R$ ✓
= $\frac{4}{2}$ ✓✓
= 2 A ✓

(4)

10.3

$R_{TOT} = \frac{V}{I}$ ✓
$= \frac{12}{2}$ ✓
= 6 Ω ✓

$R_{tot} = R_{ext} + r$ ✓
6 = 5 + r
r = 1 Ω ✓

or/of

V_{ext} = 2.5 = 10 V ✓

V_r = 2 V ✓
r = $^V/_I$ = $^2/_2$ ✓ = 1 Ω ✓

or / of

emf = I(R + r) ✓
✓ ✓ ✓
12 = 2(5 + r)
r = 1 Ω ✓

(5)
[13]

QUESTION 11 / *VRAAG 11*

11.1 attractive / *aantrekkend* ✓✓ (2)

11.2 Ampére is that constant current ✓ which, when flowing in each of two parallel conductors of ✓ infinite length and 1 m apart in vacuum ✓, produces between them a force of 2×10^{-7} N per m length ✓./ (2×10^{-7} N/m) ✓

Ampére is daardie konstante stroom ✓ wat, as dit vloei in twee ewewydige geleiers van ✓ oneindige lengte ✓ en 1 m van mekaar in 'n vakuum ✓, 'n krag van 2×10^{-7} N per meter- ✓ lengte tussen hulle veroorsaak (4)

11.3

Potential difference same across both resistors / Potensiaalverskil selfde oor beide weerstande ✓

$R_{24} : R_8 = 3 : 1 \Rightarrow I_{24} : I_8 = 1 : 3$ ✓

$\Rightarrow I_8 = 3x$

or/*of*

$$\frac{1}{R_P} = \frac{1}{24} + \frac{1}{8}$$

$$R_P = 6\Omega$$

$$V_P = I \times R_P = 4x \times 6 = 24x$$ ✓

$$I_{8\Omega} = \frac{V_P}{R_{8\Omega}} = \frac{24x}{8} = 3x$$ ✓

$V_{top} = V_{bottom}$ ✓

$24.x = 8.I$ ✓

(2)

11.4

$$F = k\frac{I_1 I_2 l}{d}$$ ✓

$$1{,}3 \times 10^{-6} = 2 \times 10^{-7} \times \frac{x \times 3x \times 0{,}03}{0{,}005}$$ ✓ ✓ ✓ ✓

$3x^2 = 1{,}072$

$x = 0{,}597$ A ✓ (0,6 A)

$I = 4x = 2{,}4$ A ✓

(POSITIVE MARKING / POSITIEF MERK)

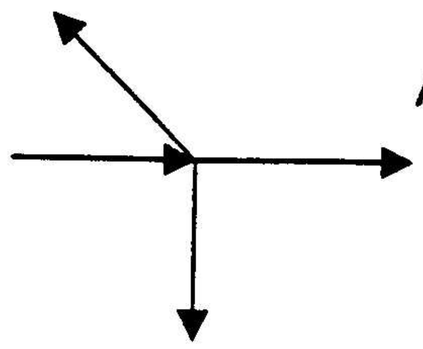
(7)

[15]

TOTAL = 200

ADDENDUM
PHYSICAL SCIENCE HG PAPER I –

2.1



A maximum of $\frac{2}{4}$

2.2 If a candidate went back to change the diagram, the final decision will be that of the moderator – taking into account the first remark on the final memorandum.

→ ! **INTERNAL MODERATORS** will have authority to use their experience in this question to make decisions, taking into account the first remark in the block on the final memorandum

3.2 Another alternative :

s = vt = 8x4 = 32 m

$32 = \left(\frac{u+v}{2}\right)t$

$32 = \left(\frac{0+v}{2}\right)4$

$v = 16\ m.s^{-1}$ 0/4

$s = ut + \frac{1}{2}at^2$ ✓

$= 0 + \frac{1}{2}(4)(4^2)$

$= 32\,m$ ✓

$s = \left(\frac{u+v}{2}\right)t$

$32 = \left(\frac{0+v}{2}\right)4$ ✓

$v = 16\,m.s^{-1}$ ✓

(4)

Zero marks will be obtained for this method as an error of principle is made in the first step – the motion is accelerated

10.3 ALTERNATIVE !!!

$V_{parallel} = I.R_{parallel} = 2 \times 3 = 6\ V$ ✓✓

$V_{ext} = 6 + 4 = 10\ V$ ✓

$V_r = 2\ V$ ✓

$r = \frac{2V}{1A} = 1\ \Omega$ ✓ (5)

4.1 $F = ma$

$= 1200.(-5)$
$= -6000\ N$

$F\Delta t = m\Delta v$ ✓
✓ ✓
$-6000 . \Delta t = 0 - (1200)(80)$
$.\Delta t = 16\ s$ ✓ (4)