REVISED MEMO PHYSICAL SCIENCES/*HERSIENE MEMO FISIESE WETENSKAPPE*
SEPTEMBER 2018

QUESTION 1/*VRAAG 1*

1.1 A ✓✓
1.2 A ✓✓
1.3 D ✓✓
1.4 C ✓✓
1.5 C ✓✓
1.6 B ✓✓
1.7 D ✓✓
1.8 A ✓✓
1.9 C ✓✓
1.10 A ✓✓

[20]

QUESTION 2/ *VRAAG 2*

2.1 The ski moves faster, accelerating down the slope/*Die ski beweeg vinniger, versnel teen die afdraand af.* ✓✓ (2)

2.2 Change in velocity or direction/*Verandering in snelheid of rigting* ✓ (1)

~~2.3.1 Yes/Ja.~~ ✓
Friction less surface.

2.3.1 Energy at top = Energy at bottom/*Energie aan bopunt = Energie aan onderpunt* ✓ ; $mgh = 1/2\ mv^2$; $gh = \frac{1}{2} v^2$ (mass do not influence velocity/*massa beïnvloed nie snelheid nie*). ✓ (2)

2.3.2 $F_f = \mu_k N = \mu_k \cdot m \cdot g\cos\theta$ ✓ $\therefore F_f \propto m$ ✓

The greater mass, the greater the frictional force and the lower or smaller the nett force, the lower the acceleration/*Hoe groter die massa is, hoe groter is die wrywingskragte en hoe laer/kleiner die netto krag, hoe laer is die versnelling.* ✓ (3)

2.4.1. $v_f^2 = v_i^2 + 2 \cdot a \cdot \Delta x$ ✓

$1.5^2 = 0^2 + 2 \cdot a \cdot 0.5$ ✓

$a = 2{,}25\ m \cdot s^{-2}$ ✓ (3)

2.4.2. **If used friction:**

$f = \mu_k \cdot N$ ✓

$f = 0,2(75)(9,8)\cos 35^\circ$ ✓

$f = \underline{120,42\ N}$ ✓

If used newton's law:

$F_{g//} - f = ma = 0$ ✓

$f = 75\ (9,8)\ \sin 35^\circ$ ✓

$f = 421,58\ N$ ✓

(3)

2.4.3 Question is omitted.

2.4.4. $F_{net} = ma$

$(0,2)(75)(9,8) = 75\ a$ ✓

$a = \underline{1,96\ m{\cdot}s^{-2}}$ ✓

(2)

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QUESTION 3/*VRAAG 3*

3.1 The product of the net force acting on an object and the time the net force acts on the object/*Die produk van die netto krag wat op 'n voorwerp inwerk en die tyd wat die netto krag op die voorwerp inwerk.* ✓✓ (2)

3.2 $F{\cdot}\Delta t = \Delta p$ ✓

75 ✓ $\cdot\Delta t = (105)(8,5) - (105)(0)$ ✓

$\Delta t = \underline{11,9s}$ ✓

(4)

3.3. An object <u>will remain</u> at rest or <u>constant velocity</u> unless an <u>unbalanced force</u> acts on it/*'n Voorwerp sal in rus bly of teen 'n konstante snelheid bly beweeg behalwe as daar 'n ongebalanseerde krag op hom inwerk.* ✓✓ (2)

3.4. $F_{net}{\cdot}\Delta t = \Delta p$ ✓

$F_{net}{\cdot}0.4 = 105(2) - 105(8,5)$ ✓ or/*of* $F_{net}\ (0.4) = 105(-2) - 105(-8,5)$ ✓

$F_{net} = -1706,25\ N$ ✓ $F_{net} = \underline{1706,25\ N}$ ✓ <u>left</u>

$F_{net} = \underline{1706,25\ N\ left}$

(3)

3.5. $F \cdot \Delta t = \Delta p$ or/*of*

$1706,25(0,4)$ ✓ $= 50v_f - 50(0)$ ✓

$v_f = 13,65 \text{ m} \cdot \text{s}^{-1}$

Before collision/*voor botsing*

$\frac{1}{2} mv^2_P + \frac{1}{2} mv^2_M$ ✓ $= \frac{1}{2}\, 105(8,5)^2 + 0$ ✓ $= 3793,125$ J

After collision/*Na botsing*

$\frac{1}{2} mv^2_P + \frac{1}{2} mv^2_M = \frac{1}{2}\, 105(2)^2 + \frac{1}{2}\, 50(13,65)^2$ ✓ $= 4868,06$ J

E_k before is not equal to E_k after / *E_k voor is nie gelyk aan E_k na* ✓ (6)

$\sum p_{before/voor} = \sum p_{after/na}$

$m_1v_i + m_2v_i = m_1v_f + m_2v_f$

$105(8,5) + 0$ ✓ $= 105(2) + 50 \cdot v_f$ ✓

$v_f = 13,65 \text{ m} \cdot \text{s}^{-1}$

3.6 The total mechanical energy (sum of gravitational potential energy and kinetic energy) in an isolated system remains constant/*Die totale meganiese energie (som van gravitasie- potensiële energie en kinetiese energie) in 'n geslote sisteem bly konstant.* ✓✓ (2)

3.7 $E_{bottm} = E_P + E_K = E_{top}$ ✓ (Bottom/*Onderkant* $E_P = 0$ and Top/*Bokant* $E_k = 0$) ✓

$E_{bottm/Onderkant} = E_K = E_{top/Bokant} = E_P$

$\frac{1}{2} mv^2$ (bottom/*onderkant*) = mgh (top/*bokant*)

$\frac{1}{2}\, 50(13,65)^2$ ✓ $= 50(9,8)h$ ✓

$\underline{h = 9,51 \text{ m}}$ ✓

Option/*Opsie* 2:

$E_k + E_P$ (top/*bo*) $= E_k + E_P$ (bottom/*onder*) ✓

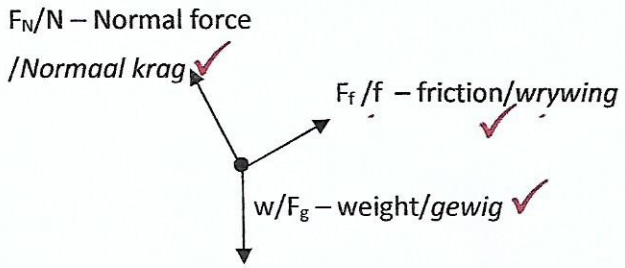
$0,5(50)(0)$ ✓ $+ 50(9,8)h$ ✓ $= 0,5(50)(13,65)^2$ ✓ $+ 50(9,8)0$

$h = \underline{9,51 \text{ m}}$ ✓ (5)

UESTION 4/*VRAAG 4*

4.1. When one body exerts a force on a second body, the second body exerts a force of equal magnitude in the opposite direction on the first body/ *Wanneer een liggaam 'n krag op 'n tweede liggaam uitoefen, oefen die tweede liggaam 'n krag gelyk in grootte en teenoorgesteld in rigting op die eerste liggaam uit.* ✓✓ (2)

4.2.



1 mark per labeled force
-1 mark if one or more arrow heads are omitted.
-1 mark if one or more arrow do not touch dot.

4.3. $W_{NC} = \Delta E_k + \Delta E_P$ ✓

$F_f \cdot 3200 = 0 - 0$ ✓ $+ (80)(9,8)(750) - (80)(9,8)(830)$ ✓

$F_f = -19,6$ N

$F_f = \mu_k N$

$19,6$ ✓ $= \mu_k (80)(9,8)\cos 30^\circ$ ✓

$\underline{\mu_k = 0,028}$ ✓ (6)

Option/*opsie* 2

$\sin 30^\circ = \frac{830}{x}$ $x = 1660$ m

$W_{NC} = \Delta E_P + \Delta E_k$ ✓

$F_f \cdot 1660 = 0 - (80)(9,8)(830) + \frac{1}{2}(80) v_f^2 - 0$ ✓

$-1660 f = -650720 + 40 v_f^2$ .....Equation 1

$\sin 30^\circ = \frac{750}{x}$ $x = 1500$ or $3200 - 1660 = 1540$

$W_{NC} = \Delta E_P + \Delta E_k$

$F_f \cdot 1500 = (80)(9,8)(750) - 0 + 0 - \frac{1}{2}(80) v_i^2$ ✓

$-1500 f = -588000 - 40 v_i^2{}_i$ .....Equation 2

If 1540 is used then

$-1540 f = -588000 - 40 v_i^2{}_i$ .....Equation 2

Equation 1 $40 v_f^2$ = Equation 2 $40 v_i^2$

$-1660 f + 650720 = 1500 f + 588000$ or $-1660 f + 650720 = 1540 f + 588000$

$f = 19,85$ N $f = 19,6$ N

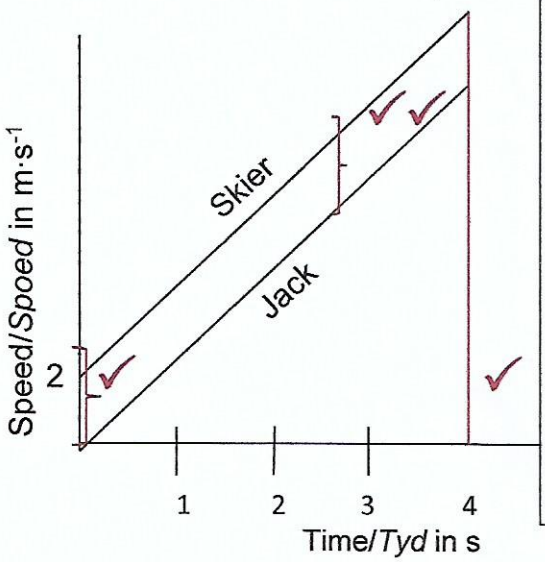
$F_f = \mu_k N$

$19,85$ ✓ $= \mu_k (80)(9,8)\cos 30^\circ$ ✓ or $19,6$ ✓ $= \mu_k (80)(9,8)\cos 30^\circ$ ✓

$\underline{\mu_k = 0,029}$ ✓ $\underline{\mu_k = 0,028}$ ✓ (6)

4.4. Since there is friction, the skier needs the ski poles to increase his speed down the slope in order to reach up the second slope/*Aangesien daar weerstand is, gebruik die skiër die ski-stokke om sy spoed te vermeerder om die top van die volgende spits te bereikt.* ✓✓ (2)

4.5.



Criteria for graph/*Kriteria vir grafiek*	Marks/ *Punte*
Time 4 s shown correctly and lines drawn up to 4 s/*Tyd 4 s korrek getoon en grafieke geteken tot 4 s*	✓
Initial velocity for Jack at time t = 0 is 0 $m \cdot s^{-1}$ and for skier 2 $m \cdot s^{-1}$/*Aanvanklike snelheid vir Jack 0* $m \cdot s^{-1}$ *en skiër 2* $m \cdot s^{-1}$	✓
Straight lines graph with 1 and 2 parallel lines/*Twee parallel reguitlyne*	✓✓

(4)

QUESTION 5/*VRAAG 5*

5.1. 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/D*ie verandering in frekwensie (of toonhoogte) van die klank waargeneem deur 'n luisteraar omdat die klankbron en die luisteraar verskillende snelhede relatief tot die medium waarin die klank voortgeplant word, het.*✓✓ (2)

5.2 $f_l = \frac{v \mp v_l}{v \mp v_s} f_s$ ✓

$f_l = \left(\frac{1519{,}44+0}{1519{,}44-13.89}\right)$ ✓✓ 1×10^3 ✓

$f_l = 1009{,}23$ Hz ✓ (5)

5.3. $f_l = \frac{v \mp v_l}{v \mp v_s} f_s$

$f_l = \left(\frac{1519{,}44+13{,}89}{1519{,}44}\right)$ ✓✓ 1009,23 ✓

$f_l = 1018{,}54$ Hz ✓ (4)

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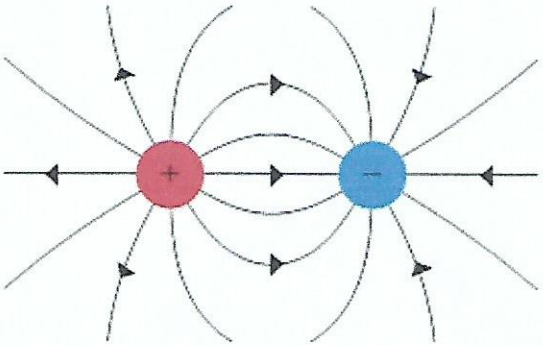
QUESTION 6/*VRAAG 6*

6.1 The magnitude of the electrostatic force exerted by one point charge (Q1) on another point charge (Q2) is directly proportional to the magnitudes of the charges and inversely proportional to the square of the distance (r) between them. */Die grootte van die elektrostatiese krag wat een puntlading (Q1) op 'n ander puntlading (Q2) uitoefen, is direk eweredig aan die groottes van die ladings en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle.* ✓✓ (2)

6.2 ✓✓✓



Mark/ *punte*	Criteria/*Kriteria*
1	Shape/*Vorm* No marks for irregular shapes/*Geen punte vir onreëlmatige vorm.*
1	Direction/*Rigting*
1	Lines touching charge/*Lyne raak ladings*

(3)

6.3. Draw more field lines closer to each other for strong electric fields and less lines farther apart for a weak electric field./*Teken meer elektriese veldlyne en nader aan mekaar vir sterk elektriese velde en min lyne vêr uit mekaar vir swak elektriesevelde.* ✓✓ (2)

6.4 $F_q = \frac{k\,q_1 q_2}{r^2}$ ✓

$F_q = \frac{9x10^9\ 1{,}6x10^{-19} 3{,}2x10^{-19}}{0{,}02^2}$ ✓✓

$F_q =$ 1,15 x10^{-24} N left ✓ (4)

QUESTION 7/*VRAAG 7*

7.1 The 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 $E = \frac{k\,Q_1}{r^2}$ ✓

$2 = \frac{9x10^9\ Q}{(0{,}5)^2}$ ✓

Q = 5,56 x 10^{-11} C ✓ (3)

7.3 $E = \frac{kQ_1}{r^2}$ ✓ $= \frac{9x10^9\ (4)}{(x)^2}$ ✓

$E = \frac{kQ_2}{r^2} = \frac{9x10^9\ (0.444\ )}{(1-x)^2}$ ✓

$E_{net} = E_1 + E_2$ ✓ $= 0\ NC^{-1}$ ✓

$E_1 = E_2$

$\frac{9x10^9\ (4\ )}{(x)^2} = \frac{9x10^9\ (0,444\ )}{(1-x)^2}$

$4(1-x)^2 = 0,444x^2$

$\underline{x = 0,75\ m}$ ✓ (6)

QUESTION 8/*VRAAG 8*

8.1 $\frac{1}{R} = \frac{1}{r} + \frac{1}{r} = \frac{1}{20} + \frac{1}{30}$ ✓ $= \frac{5}{60}$

$R = 12\ \Omega$

$R_T = 12 + 20 + 8$ ✓ $= \underline{40\ \Omega}$ ✓ (3)

8.2 $P_{av} = \frac{V_{rms}^2}{R}$ ✓

$4 = \frac{V^2}{20}$ ✓

$V = \underline{8,94\ V}$ ✓ (3)

8.3 $I_{rms} = \frac{V_{rms}}{R}$ ✓ $= \frac{8,94}{20}$ ✓ $= \underline{0,45\ A}$

$V_{rms} = I_{rms}\ R = (0,45)(12)$ ✓ $= 5,4\ V$

$I_{rms} = \frac{V_{rms}}{R} = \frac{5,4}{30}$ ✓ $= 0,18\ A$

$I_{max} = I_{rms}\sqrt{2} = 0,18\sqrt{2}$ ✓ $= \underline{0,25\ A}$ ✓ (6)

8.4 $P_{av} = I_{rms}^2\ R$ ✓ $= (0,45)^2\ (8)$ ✓ $= 1,62\ V$ ✓ (3)

8.5 Resistance inside a battery that causes the potential difference to drop as a current pass through the battery ✓ ✓ */Die weerstand in die battery wat die potensiaalverskil laat afneem wanneer 'n stroom deur die battery vloei.* (2)

8.6 $I = \frac{V}{R} = \frac{12}{40 + 0,2}$ ✓ $= \underline{0,3\ A}$ ✓ (2)

8.7 $V = IR = (0,3)(12)$ ✓ $= 3,6V$ and

$P = \frac{V^2}{R}$ ✓ $= \frac{3,6^2}{20}$ ✓ $= \underline{0,65W}$ ✓ (4)

8.5.1 Decreases/*Verlaag* ✓ (1)

8.5.2 The total resistance in the circuit increases ✓ so the current decreases ✓ */Die totale weerstand in die stroombaan verhoog, dus verlaag die stroom.* (2)

[26]

QUESTION 9/*VRAAG 9*

9.1 The minimum frequency of light needed to emit electrons from a certain metal surface/*Die minimum frekwensie lig benodig om elektrone uit 'n sekere metaaloppervlak vry te stel.* ✓ ✓ *(2)*

9.2 $5.55 \times 10^{14} - 5.58 \times 10^{14}$ ✓ ✓ Hz (2)

9.3 Particle nature/*Deeltjie natuur.* ✓ (1)

9.4 $W_o = hf_o = E_k = ½ mv^2$ ✓

$6,63 \times 10^{-34} \times 5,75 \times 10^{14}$ ✓ $= ½ 9,11 \times 10^{-31} v^2$ ✓ (range $5,75 \times 10^{14}$ $5,78 \times 10^{14}$)

$V = \underline{914842,85\ m \cdot s^{-1}}$ ✓ range ($9,15 \times 10^5 - 9,17 \times 10^5\ m.s^{-1}$)

Option/*opsie* 2

$W_o = hf_o = 6,63 \times 10^{-34} \times 5,75 \times 10^{14}$ ✓ $= 3,81 \times 10^{-19}$

Both equations ✓

$E_k = ½ mv^2$

$3,81 \times 10^{-19} = ½ 9,11 \times 10^{-31} v^2$ ✓

$v = 914330,36\ \underline{m \cdot s^{-1}}$ ✓ (with rounding off) or $914572,83\ m \cdot s^{-1}$ (without)

(Range between $9,14 \times 10^5\ m.s^{-1}$ and $9,17 \times 10^5\ m.s^{-1}$) (4)

[9]

TOTAL/*TOTAAL:* 150