

POSSIBLE ANSWERS
FEB / MARCH 2007

Physical Science P1 HG

2

Marking Guideline /

Senior Certificate Examination– Feb/Mar 2007

QUESTION 1 / VRAAG 1

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

[15 x 4 = 60]

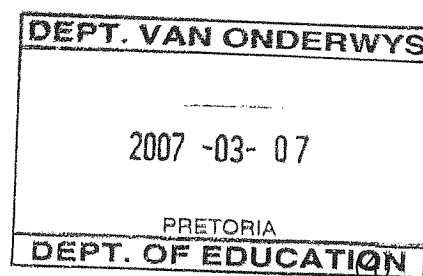
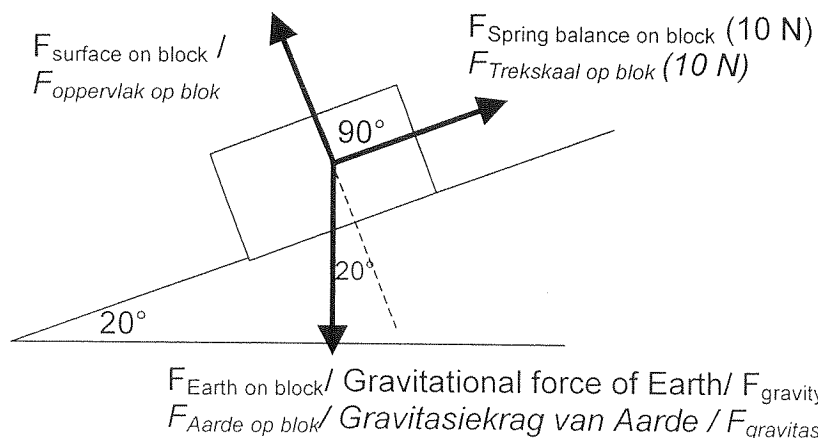
QUESTION 2 / VRAAG 2

2.1 If three forces acting at a point are in equilibrium, they can be represented in magnitude and direction by the sides of a triangle taken in order.

As drie kragte wat op 'n punt inwerk, in ewewig verkeer, kan hulle in grootte en rigting deur die drie opeenvolgende sye van 'n driekhoek voorgestel word.

(3)

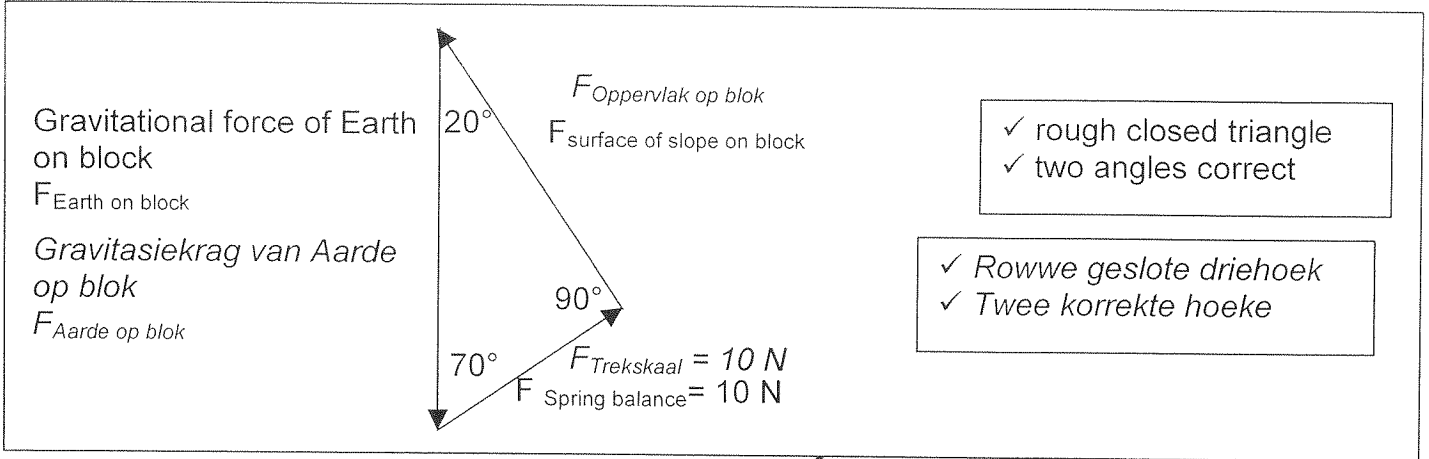
2.2



<ul style="list-style-type: none"> ✓ Force of spring balance ✓ Force Earth on block ✓ Force of slope's surface ✓ Any two correct angles 	}	Arrow plus label in each case
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<ul style="list-style-type: none"> ✓ Trekskaal se krag ✓ Aarde se krag ✓ Oppervlak se krag ✓ Enige twee korrekte hoeke 	}	Pyl plus byskrif in elke geval
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2.3



✓ rough closed triangle
✓ two angles correct

✓ Rowwe geslote driehoek
✓ Twee korrekte hoeke

$$\cos 70^\circ = \frac{F_{\text{Spring-balance}}}{F_{\text{Gravitational force of earth}}} = \frac{10}{F_{\text{Gravitational force of earth}}}$$

$$F_{\text{Gravitational force of earth}} = \frac{10}{\cos 70^\circ} = \frac{10}{0,342} = 29,24 \text{ N}$$

$$\therefore \text{Mass of trolley} = \frac{29,24}{10} = 2,924 \text{ kg}$$

$$\frac{F_G}{\sin 90^\circ} = \frac{10}{\sin 20^\circ}$$

$$F_G = 29,24 \text{ N}$$

$$\text{Mass trolley} = \frac{29,24}{10} = 2,924 \text{ kg}$$

(6)

[13]

QUESTION 3 / VRAAG 3

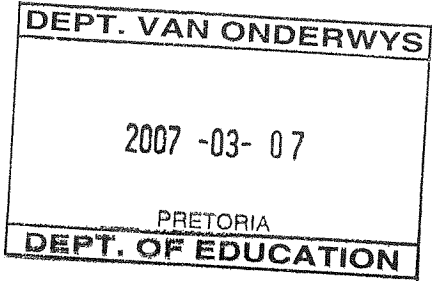
3.1

$$a = \frac{\Delta v}{\Delta t} = \frac{0 - 30}{12} = \frac{-30}{12} = -2,5 \text{ m.s}^{-2}$$

$$v = u + at$$

$$0 = 30 + a \times 12$$

$$a = -2,5 \text{ m.s}^{-2}$$



(5)

3.2

$$s = ut + \frac{1}{2}at^2$$

$$= 30 \times 0,8 + 0$$

$$= 24 \text{ m}$$

$$s_{\text{car}} = v \times t$$

$$= 30 \times 0,8$$

$$= 24 \text{ m}$$

(4)

3.3

$$s_{\text{truck}} = ut + \frac{1}{2}at^2 \quad \checkmark$$

$$= (30)(12) + \frac{1}{2}(-2,5)(12^2) \quad \checkmark$$

$$= 180 \text{ m} \quad \checkmark$$

$$v^2 = u^2 + 2as \quad \checkmark$$

$$= 30 + 2(-2,5)s \quad \checkmark$$

$$s = 180 \text{ m} \quad \checkmark$$

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

$$= \left(\frac{30+0}{2} \right) (12) \quad \checkmark$$

$$= 180 \text{ m} \quad \checkmark$$

(4)

3.4

The car travels 24 m during reaction time.

Therefore the car is **66 m** behind the position from where the truck started to slow down.

Add the 180 m the truck travelled, the car has **246 m** to stop.

Suggested following-distance is 90 m.

\therefore **distance travelled by car in order to stop**

$$v^2 = u^2 + 2as \quad \checkmark$$

$$0 = 30^2 + 2(-2)(s) \quad \checkmark$$

$$s = 225 \text{ m} \quad \checkmark$$

225 m is less than 246 (225 < 246),

\therefore car will be able to stop \checkmark

time for car to stop

$$v = u + at$$

$$0 = 30 + (-2)t$$

$$t = 15 \text{ s}$$

$$\therefore s = ut + \frac{1}{2}at^2 \quad \checkmark$$

$$s = (30 \times 15) + \left[\frac{1}{2}(-2)(15^2) \right] \quad \checkmark$$

$$= 225 \text{ m} \quad \checkmark$$

225 m is less than 246 (225 < 246)

\therefore car will be able to stop \checkmark

Assuming following distance as x

$$x + 180 = 24 + 225 \quad \checkmark$$

$\therefore x = 69 \text{ m} < 90 \text{ m}$ so car will stop. \checkmark

(a) Car travels 24 m in 0,8 s

(b) distance travelled by car in order to stop

$$v^2 = u^2 + 2as \quad \checkmark$$

$$0 = 30^2 + 2(-2)(s) \quad \checkmark$$

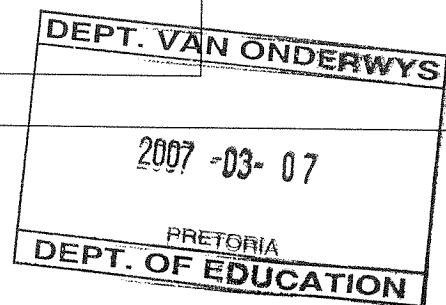
$$s = 225 \text{ m} \quad \checkmark$$

(c) Total distance for car to stop = (24 + 225) = **249 m**

(d) However total distance between truck and car = (35 + 180) = **215 m < 249 m**
CAR DOES NOT STOP IN TIME

(e) If following distance was 90 m

total distance between truck and car = (90 + 180) = **270 m > 249 m**
CAR STOPS IN TIME



(8)

[21]

QUESTION 4 / VRAAG 4

4.1

When a non-zero resultant force acts on an object, the object will accelerate in the direction of the resultant force. The acceleration is directly proportional to the resultant force and inversely proportional to the mass of the object.

Wanneer 'n nie-nul resulterende krag op 'n voorwerp inwerk, sal die voorwerp in die rigting van die resulterende krag versnel. Die versnelling is direk eweredig aan die resulterende krag en omgekeerde eweredig aan die massa van die voorwerp.

(3)

4.2

Assume the force exerted by the rod to be T/ tension in rod is T

For car:

$$F_{\text{res}} = ma \quad \checkmark$$

$$= F_{\text{applied}} - T - F_f \quad \checkmark$$

$$5a = 40 - 5 - T \quad \text{(equation 1)} \quad \checkmark$$

For trailer:

$$F_{\text{res}} = ma \quad \checkmark$$

$$= T - F_f \quad \checkmark$$

$$3a = T - 3 \quad \text{(equation 2)} \quad \checkmark$$

$$8a = 40 - 5 - T + T - 3$$

$$a = 4 \text{ m.s}^{-2} \quad \checkmark$$

(8)

4.3

Assume the force in the rod to be T; For the 5kg car:

$$F_{\text{res}} = ma \quad \checkmark$$

$$40 - 5 - T = (5)(4) \quad \checkmark$$

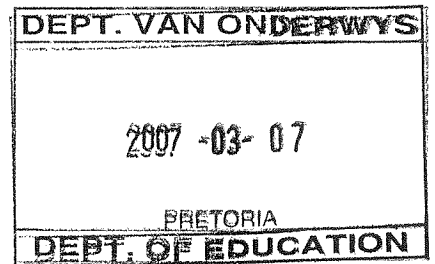
$$T = 15 \text{ N} \quad \checkmark$$

OR/
OF

From eq 2

$$(3)(4) = T - 3 \quad \checkmark$$

$$T = 15 \text{ N} \quad \checkmark$$



(3)

4.4

$$W = F_R \times s \quad \checkmark$$

$$= 32 \times 10 \quad \checkmark$$

$$= 320 \text{ J} \quad \checkmark$$

$$W = \Delta E_k \quad \checkmark$$

$$320 = \frac{1}{2} m (\Delta v^2) \quad \checkmark$$

$$= \frac{1}{2} (8) (v^2 - 0) \quad \checkmark$$

$$v^2 = 80$$

$$v = 8,94 \text{ m.s}^{-1} \quad \checkmark$$

OR/OF

$$W = F_R \times s \quad \checkmark$$

$$= 20 \times 10 \quad \checkmark$$

$$= 200 \text{ J} \quad \checkmark$$

$$W = \Delta E_k \quad \checkmark$$

$$200 = \frac{1}{2} m (\Delta v^2) \quad \checkmark$$

$$= \frac{1}{2} (5) (v^2 - 0) \quad \checkmark$$

$$v^2 = 80$$

$$v = 8,94 \text{ m.s}^{-1} \quad \checkmark$$

(8)

[22]

QUESTION 5 / VRAAG 5

5.1

$$s = ut + \frac{1}{2}at^2 \quad \checkmark$$

$$50 = 0 + \frac{1}{2}(a)(2,5)^2 \quad \checkmark$$

$$a = 16 \text{ m.s}^{-2} \quad \checkmark$$

(5)

5.2

Inertia \checkmark
 The astronaut wants to remain in a state of rest or of uniform velocity (uniform speed in a straight line) unless acted on by an external non-zero resultant force.

Traagheid \checkmark

Die ruimtevaarder poog om in 'n staat van rus of gelykmatige snelheid (gelykmatige spoed in 'n reguit lyn) te bly tensy 'n eksterne nie-nul resulterende krag op haar inwerk.

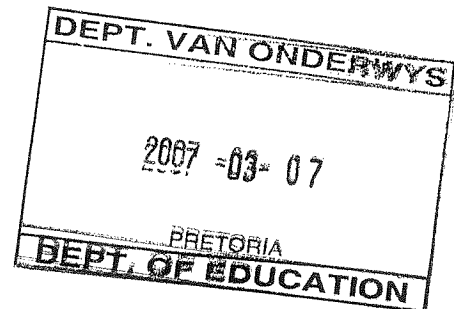
(4)

5.3

$$F_{\text{res}} = ma \quad \checkmark$$

$$F_{\text{seat}} - (70 \times 10) = 70 \times 16 \quad \checkmark$$

$$F_{\text{seat}} = 1820 \text{ N} \quad \checkmark$$



(5)

5.4

According to Newton's third law of Motion, \checkmark the force that the seat exerts on the astronaut is equal to the force that the astronaut exerts on the seat.

\therefore Learner is incorrect. \checkmark

Volgens Newton se derde bewegingswet \checkmark is die krag wat die sitplek op die ruimtevaarder uitoefen gelyk aan die krag wat die ruimtevaarder op die sitplek uitoefen.

\therefore Learner is nie korrek nie. \checkmark

(3)

5.5

The acceleration will increase \checkmark if the thrust remains the same. \checkmark

According to Newton's second law of motion acceleration is inversely proportional to the mass. \checkmark

Die versnelling sal toeneem \checkmark as die aandrywingskrag dieselfde bly. \checkmark

Volgens Newton se tweede bewegingswet is versnelling omgekeerd eweredig aan massa. \checkmark

(4)

[21]

QUESTION 6 / VRAAG 6

6.1

Mechanical energy not conserved. ✓

Only in the absence of frictional effects will the sum of the gravitational potential energy and the kinetic energy, at any point of an object's motion, be constant (conserved). ✓✓

Meganiese energie bly nie behoue nie. ✓

Slegs in die afwesigheid van wrywingseffekte sal die som van die gravitasiepotensiële en kinetiese energie konstant bly by enige punt van 'n voorwerp se beweging. ✓✓

(3)

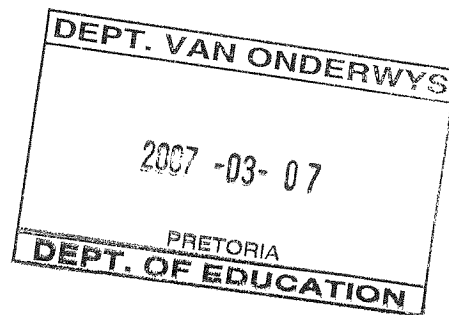
6.2

$$\begin{aligned} (E_p + E_k)_P &= (E_p + E_k)_Q + W_{\text{friction}} \quad \checkmark \\ mgh + \frac{1}{2}mv^2 &= mgh + \frac{1}{2}mv^2 + W_{\text{friction}} \quad \checkmark \\ (14)(10)(1,5) + \left(\frac{1}{2}\right)(14)(0,6^2) &= 0 + \left(\frac{1}{2}\right)(14)(3^2) + W_{\text{friction}} \\ W_{\text{friction}} &= 21 + 0,252 - 6,3 \\ &= 14,95 \text{ J} \quad \checkmark \end{aligned}$$

(8)

6.3

$$\begin{aligned} W_{\text{friction}} &= F_{\text{friction}} \times s \\ F_{\text{friction}} &= \frac{W_{\text{friction}}}{s} \quad \checkmark \\ &= \frac{14,95}{1,8} \quad \checkmark \\ &= 8,3 \text{ N} \quad \checkmark \end{aligned}$$

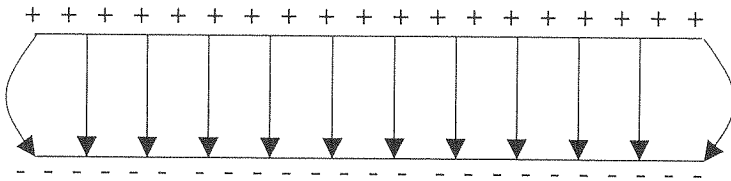


(4)

[15]

QUESTION 7 / VRAAG 7

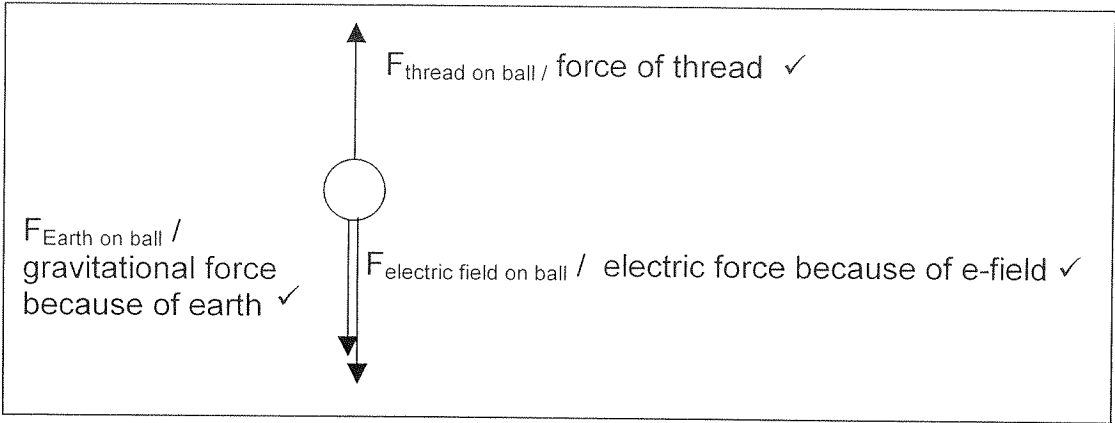
7.1



- ✓ lines parallel and evenly spaced
 - ✓ direction of field lines
 - ✓ starting and ending on plates
 - ✓ effects at side of plates
-
- ✓ lyne parallel en eweredig gespaseër
 - ✓ rigting van veldlyne
 - ✓ begin en eindig op plate
 - ✓ effek by kante van plate

(4)

7.2



(3)

7.3

$$F_{\text{gravity}} + F_{\text{electrical}} = F_{\text{thread}} \quad \checkmark$$

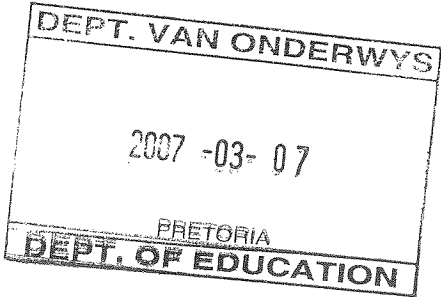
$$mg + Q \frac{V}{d} = F_{\text{silk thread}} \quad \checkmark \checkmark$$

$$(2 \times 10^{-4})(10) + (4 \times 10^{-9}) \left(\frac{1,4 \times 10^4}{0,04} \right) = F_{\text{silk thread}} \quad \checkmark$$

$$F_{\text{silk thread}} = 0,0034 \text{ N} \quad \checkmark$$

(9)

[16]



QUESTION 8 / VRAAG 8

8.1 The ampere can be defined as that current moving in two infinitely long parallel conductors placed 1 m apart in a vacuum and which will experience a force of $2 \times 10^{-7} \text{ N}$ per metre length.

(4)

8.2 towards MN

(2)

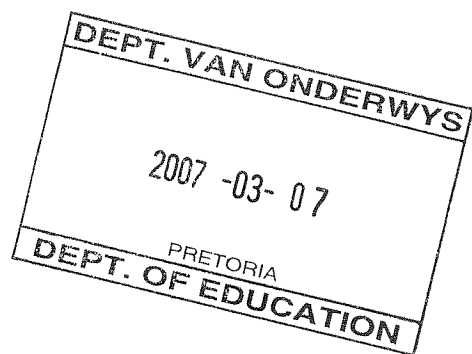
8.3

$$F = \frac{k I_1 I_2 \ell}{d}$$

$$= \frac{(2 \times 10^{-7})(14)(10)(0,25)}{0,015}$$

$$= 4,7 \times 10^{-4} \text{ N}$$

(6)

[12]

QUESTION 9

9.1

✓

The coulomb is that amount of charge which will move through a cross section of a conductor (past a given point in the conductor) in 1 second when the current in the circuit is equal to 1 ampere.

(3)

9.2 24 V ✓✓

(2)

9.3 0 V ✓✓

(2)

9.4

Parallel section :

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \checkmark$$

$$= \frac{1}{3} + \frac{1}{9} + \frac{1}{18} = \frac{9}{18} \checkmark$$

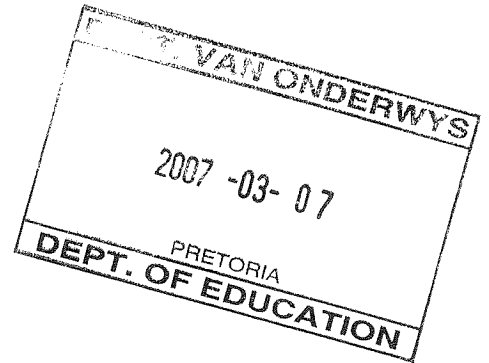
$R_p = 2 \Omega$

$\therefore R_T = R_p + 8 + 2$

$$= 2 + 8 + 2 \checkmark$$

$$= 12 \Omega \checkmark$$

No positive marking



(7)

9.5

$$I_{\text{cir}} = \frac{V}{R_T} \checkmark$$

$$= \frac{24}{12} \checkmark$$

$$= 2 \text{ A} \checkmark$$

$Q = I \times t = 2 \times 60 = 120 \text{ C} \checkmark$

No positive marking

(6)

[20]