POSSIBLE ANSWERS
FEB / MARCH 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*

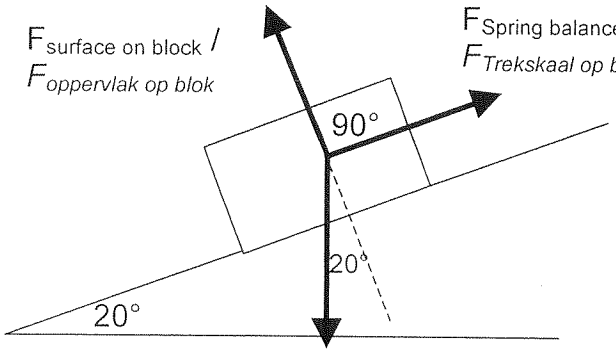
2.1

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



$F_{Earth\ on\ block}$/ Gravitational force of Earth/ $F_{gravity}$
$F_{Aarde\ op\ blok}$/ *Gravitasiekrag van Aarde* / $F_{gravitasie}$

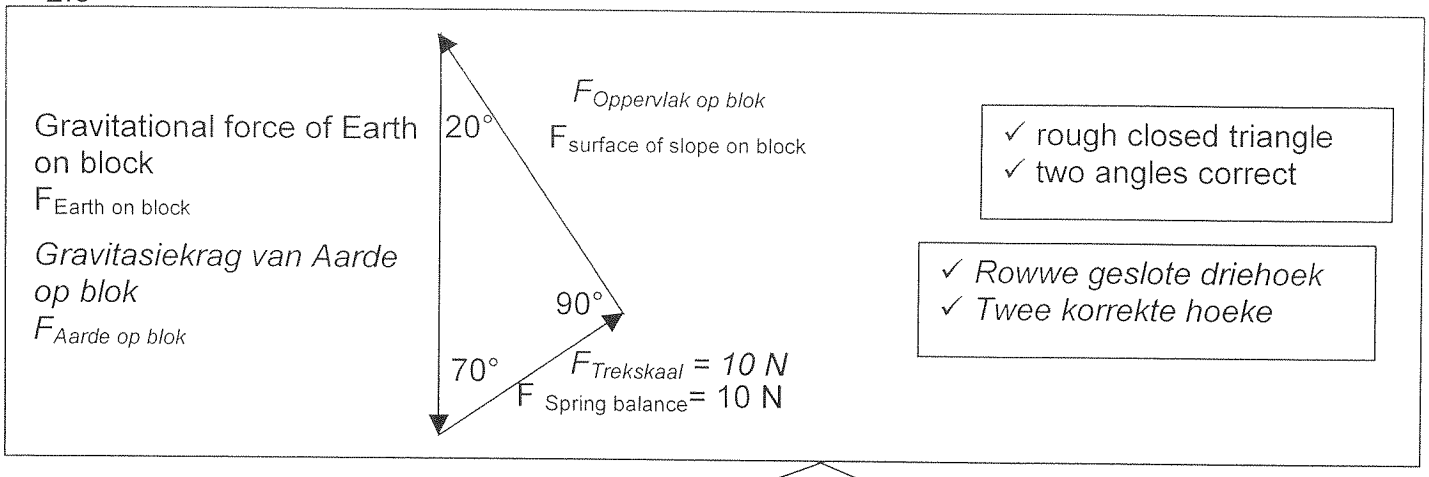
- ✓ Force of spring balance
- ✓ Force Earth on block
- ✓ Force of slope's surface
- ✓ Any two correct angles

} Arrow plus label in each case

- ✓ *Trekskaal se krag*
- ✓ *Aarde se krag*
- ✓ *Oppervlak se krag*
- ✓ *Enige twee korrekte hoeke*

} *Pyl plus byskrif in elke geval*

2.3



✓ rough closed triangle
✓ two angles correct

✓ *Rowwe geslote driehoek*
✓ *Twee korrekte hoeke*

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

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

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

$$\frac{F_G}{\sin 90°} = \frac{10 \checkmark}{\sin 20° \checkmark}$$

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

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

(6)

[13]

QUESTION 3 / *VRAAG 3*

3.1

$$a = \frac{\Delta v}{\Delta t}^{\checkmark\ \checkmark\ \checkmark} = \frac{0 - 30}{12 \checkmark}$$

$$= \frac{-30}{12}$$

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

$v = u + at$ ✓

$0 = 30 + a \times 12$ ✓ ✓ ✓

$a = -2{,}5\ m.s^{-2}$ ✓

(5)

3.2

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

$$= 30 \times 0{,}8 + 0 \quad (\checkmark\ \checkmark)$$

$$= 24\ m \checkmark$$

$s_{car} = v \times t$ ✓

$= 30 \times 0{,}8$ ✓ ✓

$= 24\ m$ ✓

(4)

3.3

$s_{truck} = ut + \frac{1}{2}at^2$ ✓

✓ ✓ ✓

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

$= 180\,m$ ✓

$v^2 = u^2 + 2as$ ✓

✓ ✓ ✓

$= 30 + 2(-2,5)s$

$s = 180\,m$ ✓

$s = \left(\frac{u+v}{2}\right)t$ ✓

✓

$= \left(\frac{30+0}{2}\right)(12)$ ✓

$= 180\,m$ ✓

(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.
∴ **distance travelled by car in order to stop**

$v^2 = u^2 + 2as$ ✓

✓ ✓ ✓

$0 = 30^2 + 2(-2)(s)$

$s = 225\,m$ ✓

225 m is less than 246 (225<246),
∴ car will be able to stop ✓

time for car to stop

$v = u + at$

$0 = 30 + (-2)t$

$t = 15\,s$

∴ $s = ut + \frac{1}{2}at^2$ ✓

✓ ✓

$s = (30 \times 15) + [\frac{1}{2}(-2)(15^2)]$ ✓

$= 225\,m$ ✓

225 m is less than 246(225 < 246)
∴ car will be able to stop ✓

Assuming following distance as x

✓ ✓ 5 marks as above

$x + 180 = 24 + 225$

✓ ✓

∴ $x = 69\,m < 90\,m$ so car will stop.

(a) Car travels 24 m in 0,8 s
(b) distance travelled by car in order to stop

$v^2 = u^2 + 2as$ ✓

✓ ✓ ✓

$0 = 30^2 + 2(-2)(s)$

$s = 225\,m$ ✓

(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:

$F_{res} = ma$ ✓

$= F_{applied} - T - F_f$

✓ ✓ ✓

$5a = 40 - 5 - T$ (equation 1)

For trailer

$F_{res} = ma$

$= T - F_f$ ✓

✓ ✓

$3a = T - 3$ (equation 2)

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

$a = 4\ m.s^{-2}$ ✓

(8)

4.3

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

$F_{res} = ma$

✓ ✓

$40 - 5 - T = (5)(4)$

$T = 15\ N$ ✓

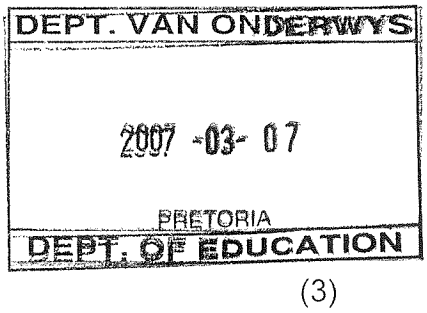
OR/ OF

From eq 2

✓ ✓

$(3)(4) = T - 3$

$T = 15\ N$ ✓



(3)

4.4

$W = F_R \times s$ ✓

✓ ✓

$= 32 \times 10$

$= 320\ J$ ✓

$W = \Delta E_k$ ✓

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

✓ ✓

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

$v^2 = 80$

$v = 8{,}94\ m.s^{-1}$ ✓

OR/OF

$W = F_R \times s$ ✓

✓ ✓

$= 20 \times 10$

$= 200\ J$ ✓

$W = \Delta E_k$ ✓

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

✓ ✓

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

$v^2 = 80$

$v = 8{,}94\ m.s^{-1}$ ✓

(8)

[22]

QUESTION 5 / VRAAG 5

5.1

$s = ut + \frac{1}{2}at^2$ ✓

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

$a = 16\ m.s^{-2}$ ✓

(5)

5.2

Inertia ✓

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 ✓

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

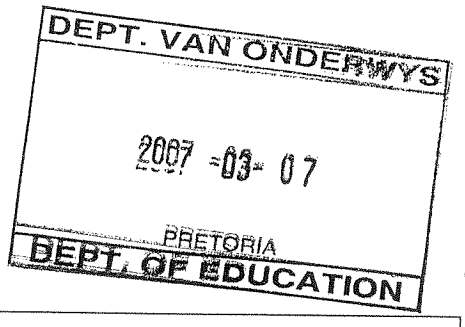
(4)

5.3

$F_{res} = ma$ ✓

$F_{seat} - (70x10) = 70x16$ ✓ ✓ ✓

$F_{seat} = 1\ 820\ N$ ✓



(5)

5.4

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

∴ Learner is incorrect. ✓

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

∴ Learder is nie korrek nie. ✓

(3)

5.5

The acceleration will increase ✓ if the thrust remains the same. ✓

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

Die versnelling sal toeneem ✓ as die aandrywingskrag dieselfde ✓ bly.

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

(4)

[21]

QUESTION 6 / *VRAAG 6*

6.1

Mechancial 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 gravitasie-potensiële en kinetiese energie konstant bly by enige punt van 'n voorwerp se beweging. ✓✓

(3)

6.2

$$(E_p + E_k)_P = (E_p + E_k)_Q + W_{friction} \quad \checkmark$$

$$mgh + \frac{1}{2}mv^2 = mgh + \frac{1}{2}mv^2 + W_{friction}$$

$$(1,4)(10)(1,5) + (\tfrac{1}{2})(1,4)(0,6^2) = 0 + (\tfrac{1}{2})(1,4)(3^2) + W_{friction}$$

$$W_{friction} = 21 + 0,252 - 6,3$$

$$= 14,95 \text{ J} \quad \checkmark$$

(8)

6.3

$$W_{friction} = F_{friction} \times s$$

$$F_{friction} = \frac{W_{friction}}{s} \quad \checkmark$$

$$= \frac{14,95}{1,8} \quad \checkmark$$

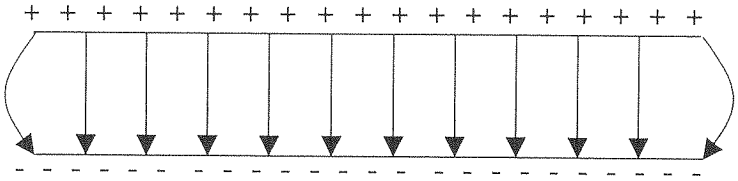
$$= 8,3 \text{ N} \quad \checkmark$$

(4)

[15]

QUESTION 7 / *VRAAG 7*

7.1

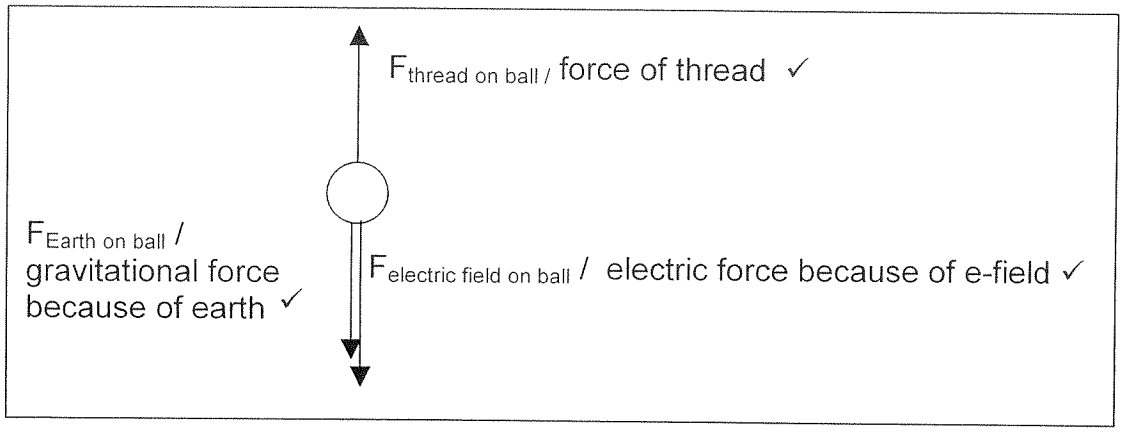


- ✓ lines parallel and evenly spaced
- ✓ direction of field lines
- ✓ starting and ending on plates
- ✓ effects at side of plates

- ✓ *lyne parallel en eweredig gespasieër*
- ✓ *rigting van veldlyne*
- ✓ *begin en eindig op plate*
- ✓ *effek by kante van plate*

(4)

7.2



(3)

7.3

$$F_{gravity} + F_{electrical} = F_{thread} \quad ✓$$

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

$$(2\times10^{-4})(10) + (4\times10^{-9})\left(\frac{1,4\times10^{4}}{0,04}\right) = F_{silk\ thread} \quad ✓✓✓$$

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

(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 $2x10^{-7}$N per metre length. ✓✓

(4)

8.2 towards MN ✓✓

(2)

8.3
$$F = \frac{kI_1I_2\ell}{d} \quad \checkmark$$
$$= \frac{(2x10^{-7})(14)(10)(0,25)}{0,015} \quad \checkmark\checkmark\checkmark \checkmark$$
$$= 4,7x10^{-4}\ N \quad \checkmark$$

(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 :

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

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

$R_P = 2\Omega$

No positive marking

$\therefore R_T = R_P + 8 + 2$ ✓

$= 2 + 8 + 2$ ✓

$= 12\Omega$ ✓

(7)

9.5

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

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

$= 2A$

$Q = I \times t = 2 \times 60 = 120C$ ✓ ✓ ✓

No positive marking

(6)

[20]

QUESTION 1/VRAAG 1 : 60
QUESTION 2 – 9/ VRAE 2 – 9 : 140
GRAND TOTAL/ GROOTTOTAAL : 200