

POSSIBLE ANSWERS FOR / MOONTLIKE ANTWOORDE VIR :

PHYSICAL SCIENCE FINAL

SG NOV 2003

**NATIONAL DEPARTMENT OF EDUCATION
NASIONALE ONDERWYSDEPARTEMENT**

PHYSICAL SCIENCE (SG)

PAPER 1

NATUUR- EN SKEIKUNDE (SG) VRAESTEL 1

NOVEMBER 2003

QUESTION 1 / VRAAG 1

1.1 A 1.2 D 1.3 B 1.4 C 1.5 B 1.6 A 1.7 D

1.8 B 1.9 A 1.10 C 1.11 D 1.12 A/B 1.13 C 1.14 B

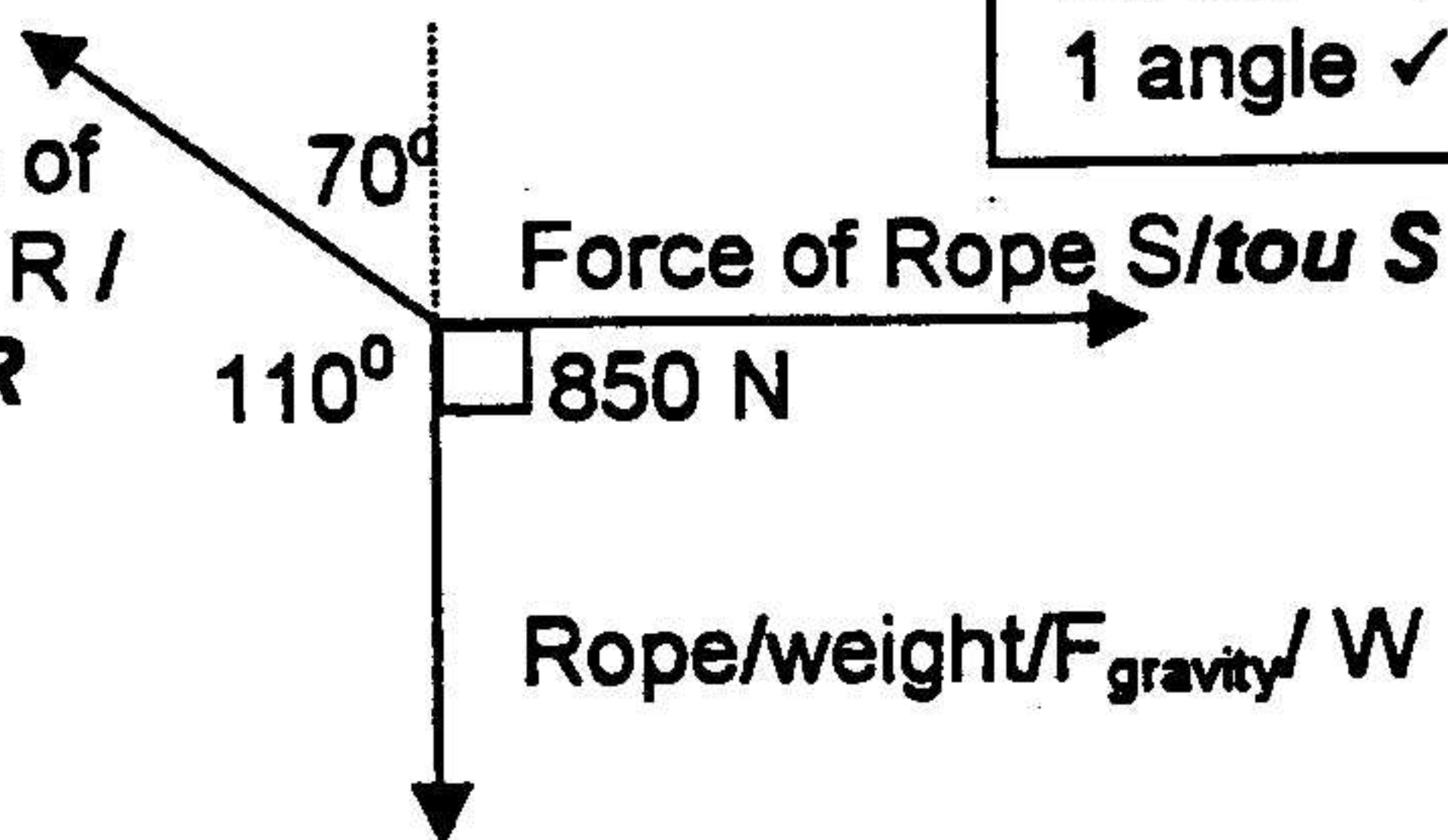
1.15 D

(15 X 3 = 45)

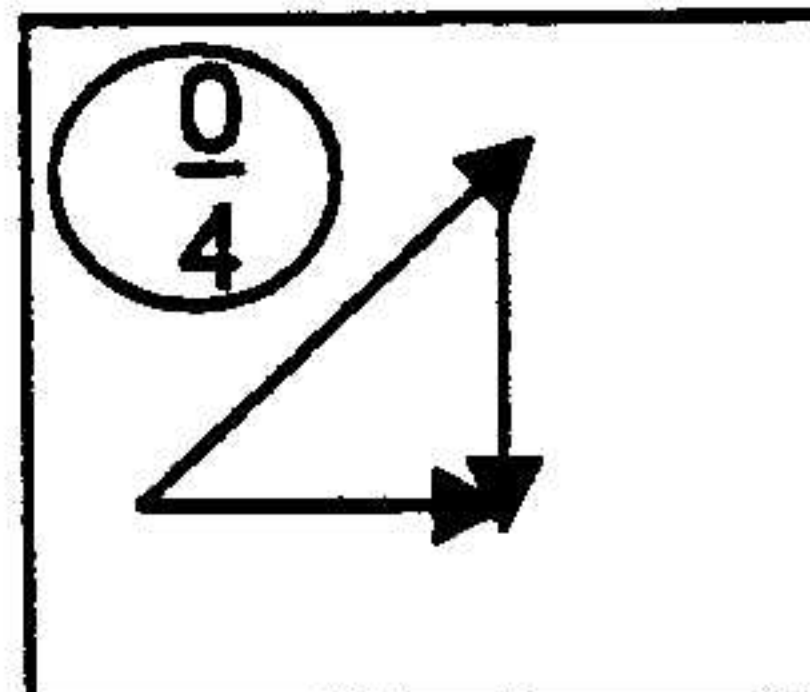
1.12 The English and Afrikaans versions differed in the answers of A and B. They were just swapped around and to solve a marking problem which could arise in certain provinces where candidates saw both English and Afrikaans questions, the decision was taken to accept both A and B as correct answers.

QUESTION 2 / VRAAG 2

2.1 Force of Rope R / *Tou R*



arrows ✓ / *pylpunte*
orientation of 3 forces ✓
orientasie van 3 kragte
labels ✓ / *byskrifte*
1 angle ✓ / *een hoek*

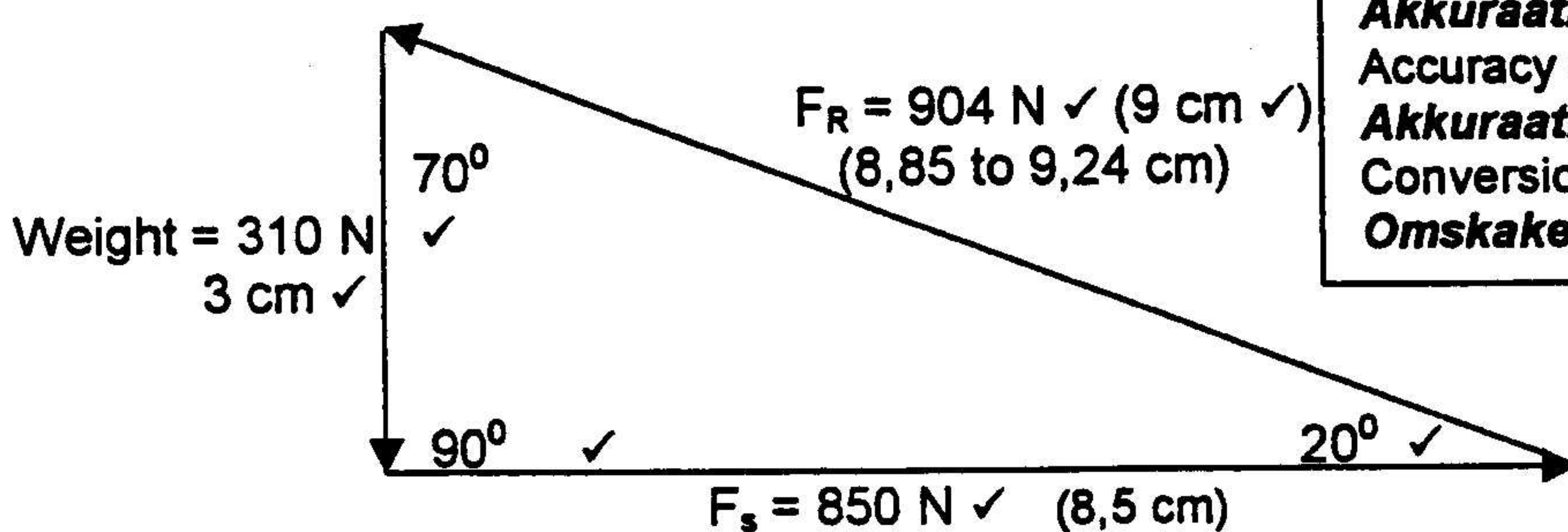


If correct triangle then
-1 for orientation
relative to point P / *as*
korrekte driehoek
dan : -1 vir orientasie
→(3/4)

(4)

W is not acceptable, but as 1 mark is allocated for labels it will be allowed

2.2 scale / *skaal* 1 cm : 100 N



Accuracy of horizontal vector ✓
Akkuraatheid horisontale vektor
Accuracy of any two angles ✓✓
Akkuraatheid enige twee hoek
Accuracy of two other vectors ✓✓ 2 or 0
Akkuraatheid enige ander twee vektore
Conversion of the two vectors ✓✓
Omskakeling van twee vektore

tolerance level for scale drawing = ± 2 mm

FR = 885 N to 924 N is acceptable, W = 289 N to 329 N is
Acceptable (8,85 cm to 9,24 cm) is acceptable

If calculations done/
As berekening 0/7
gedoen:
If diagram accurate
with calculations /
As skets akkuraat
met berekening 5/7

A non zero resultant vector
diagram - max 5/7

(7)

2.3 m = 31 kg ✓✓ (29 – 33) kg

(2)
[13]

QUESTION 3 / VRAAG 3

3.1

$$s = vt \checkmark$$

$$= 20 \times 2 \checkmark$$

$$= 40 \text{ m} \checkmark$$

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

$$= (20)(2) + 0 \checkmark$$

$$= 40 \text{ m} \checkmark$$

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

$$= \left(\frac{20+20}{2}\right)(2) \checkmark$$

$$= 40 \text{ m} \checkmark$$

(3)

3.2

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

$$0^2 = 20^2 + 2 \cdot a \cdot 100 \checkmark$$

$$a = -2 \text{ m} \cdot \text{s}^{-2}$$

$$= 2 \text{ m} \cdot \text{s}^{-2} \checkmark \text{ opp. to direction of motion} \checkmark$$

teenoorgestelde rigting van beweging (-2 m.s⁻² gets mark)

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

$$0^2 = 20^2 + 2 \cdot a \cdot 140 \checkmark$$

$$a = -1,43 \text{ m} \cdot \text{s}^{-2}$$

$$a = 1,43 \text{ m} \cdot \text{s}^{-2} \checkmark \text{ opp. to direction of motion} \checkmark$$

teenoorgestelde rigting van beweging

$\frac{4}{6}$

→ If u and v swapped :
→ As u en v omgeruil :

$\frac{4}{6}$

If answer in 3.1 is 20 m / As antwoord in 3.1 = 20 m
 $v^2 = u^2 + 2as \checkmark$ → Positive marking from 3.1
Positiewe nasien vanaf 3.1

$$0^2 = 20^2 + (2)a(120) \checkmark \checkmark$$

$$a = -1,67 \text{ m} \cdot \text{s}^{-2}$$

$$a = 1,67 \text{ m} \cdot \text{s}^{-2} \checkmark \text{ opp. to direction of motion} \checkmark$$

teenoorgestelde rigting van beweging

(6)

3.3

$$v = u + at \checkmark$$

$$0 = 20 + -2t \checkmark$$

$$t = 10 \text{ s} \checkmark$$

total time = 2 + 10 = 12 s ✓
totale tyd:

If / as $a = -1,67 \text{ m} \cdot \text{s}^{-2}$
 $t = 11,98 \text{ s} \checkmark \checkmark \checkmark \checkmark$
 ∴ total time = 11,98 + 2 = 13,98 s
totale tyd:

If / as $a = -1,43 \text{ m} \cdot \text{s}^{-2}$
 $t = 13,98 \text{ s} \checkmark \checkmark \checkmark \checkmark$
 ∴ total time = 13,98 + 2 = 15,98 s
totale tyd:

(5)

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

$$100 = \left(\frac{20+0}{2}\right)t \checkmark$$

$$t = 10 \text{ s} \checkmark$$

Total time = 12 s ✓

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

$$100 = 20t + \frac{1}{2}(-2)t^2 \checkmark$$

$$t = 10 \text{ s} \checkmark$$

Total time = 12 s ✓

→ If u and v swapped :
→ As u en v omgeruil :

$\frac{3}{5}$

QUESTION 4 / VRAAG 4

- 4.1 Towards the front of the truck (In the direction of the truck / to the left / west/ forward) ✓✓ (2)

Na die voorkant van die trok (In die rigting van die trok / na links / wes Voorentoe)

- 4.2 Newton's First Law, (N I , Newton I) ✓

An object continues in its state of rest or of uniform velocity (uniform speed in a straight line) unless a non zero resultant force acts on it.

Newton se Eerste wet. (N I , Newton I) ✓

'n Voorwerp sal in sy toestand van rus bly of teen uniforme snelheid

(uniforme spoed in 'n reguit lyn) volhard tensy 'n nie-zero resulterende krag

daarop inwerk.

(4)

[6]

QUESTION 5 / VRAAG 5

- 5.1.1 resultant force / **resulterende krag** ✓✓ (only force / **krag**) ✗

(2 or 0)

- 5.1.2 acceleration in the same direction as F_{RES} ✓
versnelling is in dieselfde rigting as F_{RES}

(1)

- 5.1.3 1 N is that resultant force which acts on a 1 kg object to produce an acceleration of 1 m.s^{-2}

1 N is daardie resulterende krag wat as dit op 'n 1 kg voorwerp inwerk 'n versnelling van 1 m.s^{-2} tot gevolg sal hê

If order of definition not correct → 1/2 / As orde van definisie nie korrek → 1/2

(2 or 0)

- 5.2 uniform / constant velocity or constant speed (in the same direction)
zero acceleration

(at rest or stationary carries no mark)

eenvormige / konstante snelheid of konstante spoed (in dieselfde rigting)

zero versnelling

(in rus of stilstaande sal nie punte verdien nie)

(2 or 0)

5.3.1

$$v = u + at \quad \checkmark$$

$$25 = 0 + a \cdot 4 \quad \checkmark$$

$$a = 6,25 \text{ m.s}^{-2} \quad \checkmark$$

(4)

5.3.2

$$F = ma \quad \checkmark$$

$$= (260)(6,25) \quad \checkmark$$

$$= 1625 \text{ N} \quad \checkmark$$

If rounded off to $6,3 \text{ m.s}^{-2}$ and used in 5.3.2 \rightarrow accept $F = 1\ 638 \text{ N}$
As afgerond tot $6,3 \text{ m.s}^{-2}$ en gebruik in 5.3.2 \rightarrow aanvaar $F = 1\ 638 \text{ N}$

(3)

5.3.3

$$E_k = \frac{1}{2} mv^2 \quad \checkmark$$

$$= \frac{1}{2} 260 \times (25)^2 \quad \checkmark$$

$$= 81\ 250 \text{ J} \quad \checkmark$$

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

$$= \left(\frac{0+25}{2}\right) 4$$

$$= 50 \text{ m}$$

$$\checkmark \quad \checkmark$$

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

$$= \frac{1}{2} (6,25)(4)^2$$

$$= 50 \text{ m}$$

$$\checkmark$$

$$W = Fs = 1625 \times 50 = 81250 \text{ J}$$

(3)

[17]

QUESTION 6 / VRAAG 6

6.1

$$p = mv \quad \checkmark = 0,4 \times 30 \quad \checkmark = 12 \text{ kg.m.s}^{-1} \quad \checkmark.$$

(3)

6.2

$$\Delta p = mv - mu \quad \checkmark$$

$$= 0,4 \times (-40) - 0,4 \times 30 \quad \checkmark$$

$$= -16 - 12 = -28 \text{ kg.m.s}^{-1} \quad \checkmark$$

away from the bat \checkmark or along the direction of force applied
weg

\checkmark for substitution of mass
 \checkmark for substitution of both velocities

(5)

v and u must have opposite signs / v en u moet teenoorgestelde tekens hê
 \rightarrow direction can be marked independently
 \rightarrow rigting kan onafhanklik gemerk word

[8]

QUESTION 7 / VRAAG 7

7.1

$$E_p = mgh = 0,6 \times 10 \times 70$$

$$= 420 \text{ J}$$

7.2

$$E_k = \frac{1}{2}mv^2$$

$$187,5 = \frac{1}{2} \times 0,6 \times v^2$$

$$v = 25 \text{ m.s}^{-1}$$

7.3

$$(E_k + E_p)_P = (E_p + E_k)_{top}$$

$$187,5 + (0,6)(10)h = 420$$

$$h = 38,75 \text{ m}$$

$$E_{k(\text{gained})} = E_{p(\text{lost})}$$

$$187,5 = mg\Delta h$$

$$= 0,6 \times 10 \times \Delta h$$

$$h = 31,25 \text{ m}$$

$$h_{P \text{ ABOVE WATER}} = 70 - 31,25 = 38,75 \text{ m}$$

XX

$$E_{p \text{ lost}} = mg\Delta h$$

$$232,5 = 0,6 \times 10 \times \Delta h$$

$$h = 38,75 \text{ m}$$

$$E_{p(P)} \text{ or } E_{p(\text{left})} \text{ or } E_{p(\text{remain})} = mgh$$

$$232,5 = 0,6 \times 10 \times h$$

$$h = 38,75 \text{ m}$$

$$V = u + gt = 10 \times 4 = 40 \text{ m.s}^{-1}$$

$$E_k = \frac{1}{2}mv^2 = \frac{1}{2}(0,6)40^2 = 480 \text{ J}$$

If 4 s used / as 4 s gebruik !!!

(3)

(4)

$$(E_k + E_p)_P = (E_p + E_k)_{top}$$

$$187,5 + (0,6)(10)h = 480$$

$$h = 48,75 \text{ m}$$

(5)

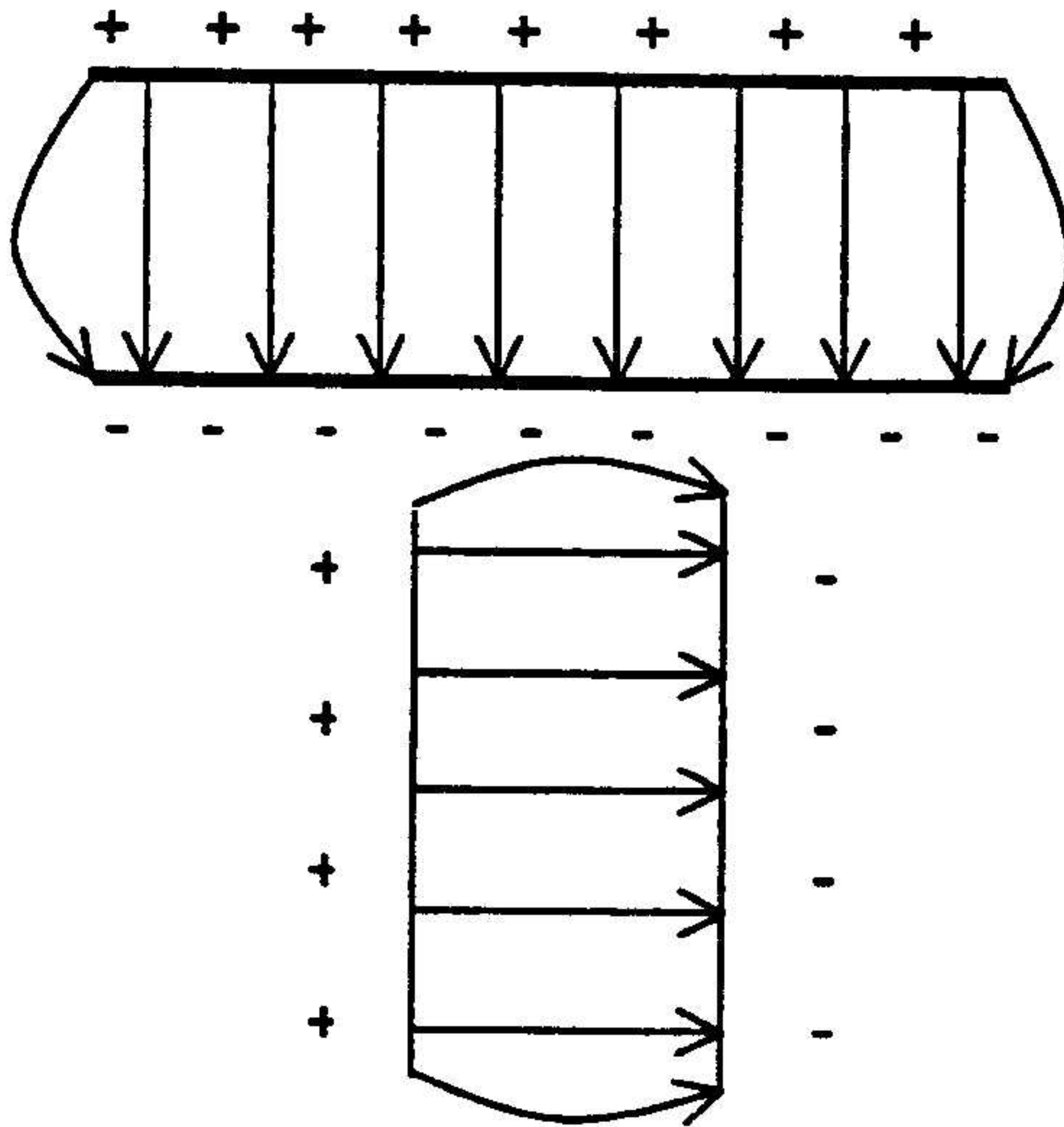
[12]

QUESTION 8 / VRAAG 8

8.1 Electric field strength is the force per unit positive (point/test) charge .
Elektriese veldsterkte is die krag per eenheids positiewe (punt/toets) lading

(3)

- 8.2
- ✓ parallel lines inside
parallele lyne
 - ✓ lines equally spaced
lyne eweredig versprei
 - ✓ arrow direction
pylpunte rigting
 - ✓ end effect, lines bent
randeffekte
- polarity of plates must be shown!



(4)

8.3

$$E = \frac{F}{q} \quad \checkmark$$

$$7500 = \frac{F}{8 \times 10^{-10}} \quad \checkmark$$

$$F = 6 \times 10^{-6} \text{ N} \quad \checkmark$$

Ignore negative sign for 8.3 and 8.4
Ignoreer negatiewe teken vir 8.3 en 8.4

(4)

8.4

$$W = F \cdot s \quad \checkmark$$

$$= 6 \times 10^{-6} \times 0,015 \quad \checkmark$$

$$= 9 \times 10^{-8} \text{ J} \quad \checkmark$$

$$W = QEs \quad \checkmark$$

$$= (8 \times 10^{-10})(7500)(0,015) \quad \checkmark$$

$$= 9 \times 10^{-8} \text{ J} \quad \checkmark$$

If $s = 15 \text{ mm}$ is substituted / *As $s = 15 \text{ mm}$*
ingestel word
 $W = 9 \times 10^{-5} \text{ J}$

$\frac{3}{4}$

(4)

[15]

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QUESTION 9 / VRAAG 9

9.1

The electric current in a conductor is directly proportional to the potential difference between its ends, ✓✓ if its temperature remains constant. ✓

OR

✓✓

The ratio of potential difference to current remains a constant provided the temperature remains the same. ✓

Die elektriese stroom in 'n geleier is direk eweredig aan die Potensiaalverskil tussen die punte ✓✓ **as die temperatuur konstant bly** ✓

OF

✓✓

Die verhouding van die potensiaalverskil tot die stroom bly konstant as die temperatuur konstant bly ✓

(3)

9.2

$$\frac{1}{R_p} = \frac{1}{20} + \frac{1}{30}, \quad R_p = 12 \Omega \quad \checkmark$$

$$R_{\text{circuit}} = 12 + 3 = 15 \Omega \quad \checkmark$$

$$R_p = \frac{20 \times 30}{20 + 30} \quad \checkmark$$

$$= 12 \Omega \quad \checkmark$$

$$R_{\text{circuit}} = 12 + 3 = 15 \Omega \quad \checkmark$$

(4)

9.3

$$I_{\text{cir}} = \frac{V_{\text{cir}}}{R_{\text{cir}}} = \frac{24}{15} = 1,6 \text{ A} \quad \checkmark$$

(3)

9.4

$$V_{20} = I_{\text{cir}} R_p = 1,6 \times 12 = 19,2 \text{ V} \quad \checkmark$$

$$V_{3\Omega} = IR = 1,6 \times 3 = 4,8 \text{ V} \quad \checkmark$$

$$V_p = V_{20} = 24 - 4,8$$

$$= 19,2 \text{ V} \quad \checkmark$$

(3)

[13]

QUESTION 10 / VRAAG 10

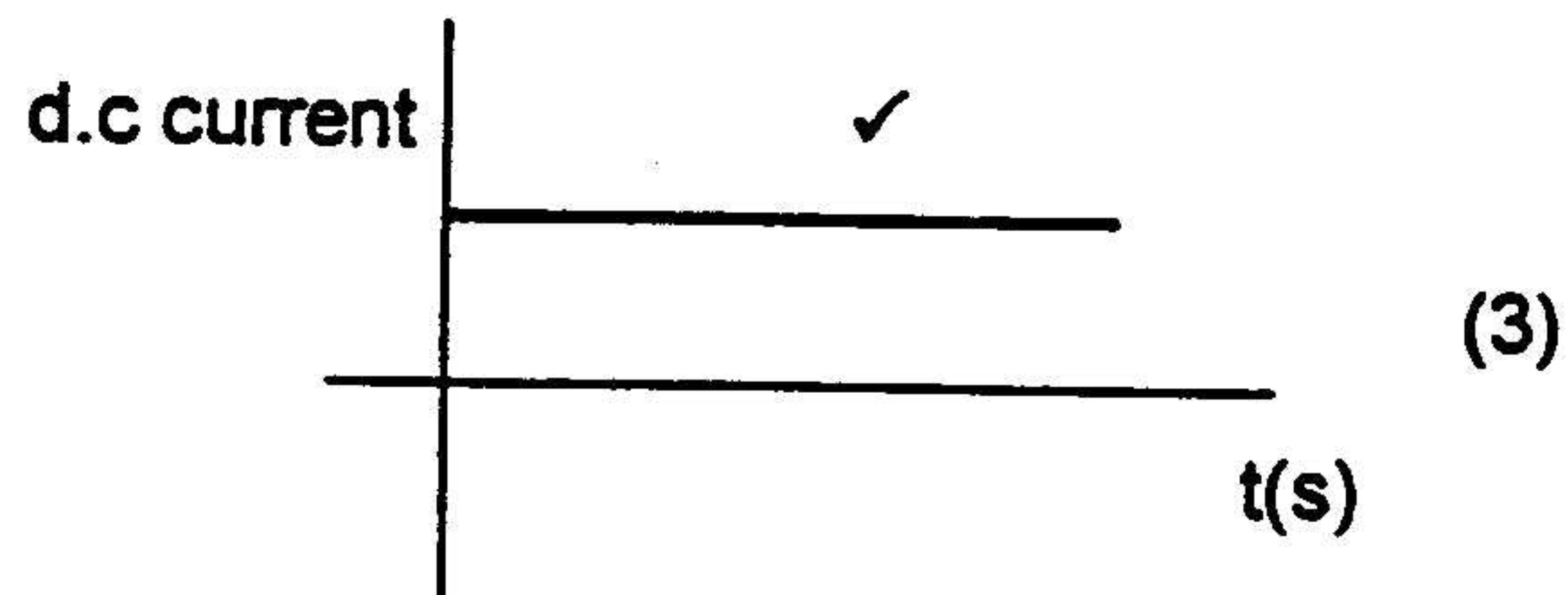
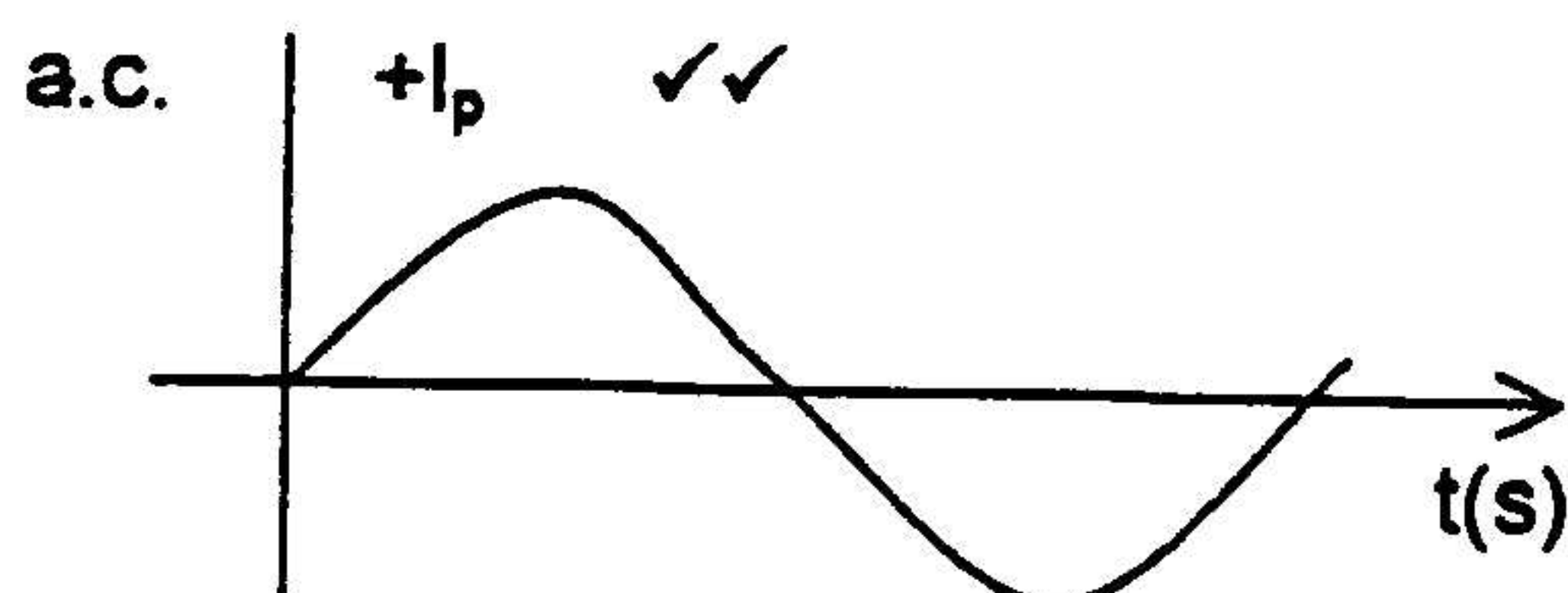
10.1 Direct current - flow of charge in one direction only (flows from + to - terminal of a battery through an external circuit (resistance)). ✓

Gelykstroom - beweging van lading in een rigting (van + na - terminaal) ✓

Alternating current - the flow of charge changes direction continually between two opposite directions or the potential difference alternates between a + maximum and a - maximum.

Wisselstroom - die beweging van lading verander gedurig van rigting tussen twee teenoorgestelde rigtings of die potensiaalverskil wissel tussen 'n + maksimum en 'n - maksimum.

or a graph of ac showing the variation of I or V with time is acceptable. i.e



10.2

$$W = P \cdot t \quad \checkmark$$

$$= 1500 \times 3 \times 60 \quad \checkmark$$

$$= 270\,000 \text{ J} \quad \checkmark$$

Can be solved using :

$$P = VI \text{ and then } W = VIt$$

Or

$$\text{Calc R from } P = \frac{V^2}{R} \text{ and then } W = I^2 Rt$$

$$1500 = 240 I$$

$$I = 6,25 \text{ A}$$

$$\rightarrow W = VIt = 240 \times 6,25 \times 180 = 270\,000 \text{ J}$$

$$R = V^2/P = 240^2 \div 1500 = 38,4 \Omega$$

$$W = I^2 Rt = (6,25)^2 \times 38,4 \times 180 = 270\,000 \text{ J}$$

[7]

GRAND TOTAL: 150