

# SA's Leading Past Year

## Exam Paper Portal



You have Downloaded, yet Another Great Resource to assist you with your Studies 😊

Thank You for Supporting SA Exam Papers

Your Leading Past Year Exam Paper Resource Portal

Visit us @ [www.saexampapers.co.za](http://www.saexampapers.co.za)



**SA EXAM  
PAPERS**  
SA EXAM  
PAPERS



**LIMPOPO**  
PROVINCIAL GOVERNMENT  
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF  
**EDUCATION**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**PHYSICAL SCIENCES  
PHYSICS (P1)  
MARKING GUIDELINES  
PRE-TRIAL EXAMINATION  
02 AUGUST 2024**

**MARKS: 150**

**TIME: 3 hours**

**This marking guidelines consists of 20 pages**

**QUESTION 1:****MULTIPLE-CHOICE QUESTIONS**

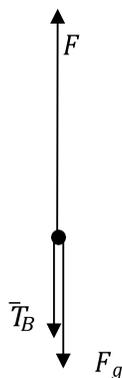
- 1.1 C ✓✓ (2)
- 1.2 A ✓✓ (2)
- 1.3 B ✓✓ (2)
- 1.4 D ✓✓ (2)
- 1.5 D ✓✓ (2)
- 1.6 C ✓✓ (2)
- 1.7 A ✓✓ (2)
- 1.8 C ✓✓ (2)
- 1.9 D ✓✓ (2)
- 1.10 B ✓✓ (2)
- [20]**

**QUESTION 2/VRAAG 2**

- 2.1 When a resultant/net force acts on an object, the object will accelerate in the direction of the force and the acceleration is directly proportional to the force ✓ and inversely proportional to the mass of the object. ✓

(2)

2.2



ACCEPT



Accepted labels		
F	$F_{app}$ / $F_A$ /applied force (accept T/tension)	✓
$F_g$	w/ $F_w$ /weight/mg/gravitational force	✓
T	$F_T$ /Tension	✓

**Notes**

- Marks awarded for label and arrow.
- Do not penalise for length of arrows since drawing is not to scale.
- Any other additional force(s). *Max 2*
- If force(s) do not make contact with body. *Max 2*
- Do not penalise if vector notation is not used.

3

(3)

2.3.1 **Option 1**

$$\begin{aligned}
 f_k &= \mu_k N \\
 &= \mu_k mg \\
 &= 0,3 \times 5 \times 9,8 \checkmark \\
 &= 14,7 \text{ N } \checkmark
 \end{aligned}$$

**Option 2**

$$\begin{aligned}
 N &= mg \\
 &= 5 \times 9,8 \\
 &= 49
 \end{aligned}$$

$$\begin{aligned}
 f_k &= \mu_k N \checkmark \\
 &= 0,3 \times 49 \checkmark \\
 &= 14,7 \text{ N } \checkmark
 \end{aligned}$$

(3)

2.3.2 **POSITIVE MARKING FROM 2.3.1****Option 1**

Direction of motion as positive

$$\begin{aligned}
 F_{\text{net}} &= ma \checkmark \\
 F + F_g + T &= ma \\
 120 - 10 \times 9,8 - T &= 10a \\
 \underline{22 - T} &= 10a \\
 F_{\text{net}} &= ma \\
 T - f_k &= ma \\
 \underline{T - 14,7} &= 5a \checkmark \\
 a &= 0,487 \\
 T - 14,7 &= 5(0,487) \checkmark \\
 T &= 17,13 \text{ N } \checkmark \\
 \text{OR} \\
 T &= 22 - 10a \\
 &= 22 - 10(0,487) \\
 &= 17,13 \text{ N}
 \end{aligned}$$

**Notes**

- Formula
- Substitution for forces
- Substitution for both masses
- Equating Tension forces
- Answer with units



**Option 2**

Direction of motion as negative

$$\begin{aligned}
 F_{\text{net}} &= ma \checkmark \\
 F + F_g + T &= ma \\
 10 \times 9,8 + T - 120 &= -10a \\
 \hline
 T - 22 &= -10a \\
 \\
 F_{\text{net}} &= ma \\
 f_k - T &= -ma \\
 14,7 - T &= -5a \\
 \hline
 a &= 0,487 \\
 14,7 - T &= -5(0,487) \checkmark \\
 -T &= -17,13 \\
 T &= 17,13 \text{ N} \checkmark \\
 \text{OR} \\
 T - 22 &= -10a \\
 T &= 22 - 10(0,487) \\
 &= 17,13 \text{ N}
 \end{aligned}$$

2.4.1 Each body in the universe attracts every other body with a force that is directly proportional to the product of their masses  $\checkmark$  and inversely proportional to the square of the distance between their centres.  $\checkmark$

(2)



2.4.2

$$F_{\text{planet/planeet}} = \frac{1}{2} F_{\text{earth/aarde}} \checkmark$$

$$G \frac{M_m 2M_e}{(X)^2} = \frac{1}{2} G \frac{M_m M_e}{R^2} \checkmark$$

$$4R^2 = (X)^2$$

$$2R = X \checkmark$$

**Notes:**

- ✓ ✓ Formula of Gravitational law applied for each object..
- ✓ Relationship between  $F_{\text{planet}}$  and  $F_{\text{earth}}$ .
- ✓ Answer

(4)

**[20]**

**QUESTION 3****3.1.1 UPWARD POSITIVE**

$$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$-(48) \checkmark = v_i \times 2,8 + \frac{1}{2} \times (-9,8) \times 2,8^2 \checkmark$$

$$V_i = -3,42$$

$$V_i = 3,42 \text{ m.s}^{-1} \checkmark$$

**DOWNWARD POSITIVE**

$$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$(48) \checkmark = v_i \times 2,8 + \frac{1}{2} \times 9,8 \times 2,8^2 \checkmark$$

$$V_i = 3,42 \text{ m.s}^{-1} \checkmark \quad (4)$$

**3.1.2 UPWARD POSITIVE/**

$$V_f = V_i + a \Delta t \checkmark$$

$$V_f = -3,42 + (-9,8) (2,8) \checkmark$$

$$V_f = -30,86 \text{ m.s}^{-1}$$

$$V_f = 30,86 \text{ m.s}^{-1} \checkmark$$

**OPTION 1****DOWNWARD POSITIVE /**

$$V_f = V_i + a \Delta t \checkmark$$

$$V_f = 3,42 + (9,8) (2,8) \checkmark$$

$$V_f = 30,86 \text{ m.s}^{-1} \checkmark \quad (3)$$

**OPTION 2****UPWARD POSITIVE**

$$V_f^2 = V_i^2 + 2a \Delta x \checkmark$$

$$V_f^2 = -3,42^2 + 2 (-9,8) (-48) \checkmark$$

$$V_f = 30,86 \text{ m.s}^{-1} \checkmark$$

**DOWNWARD POSITIVE**

$$V_f^2 = V_i^2 + 2a \Delta x \checkmark$$

$$V_f^2 = 3,42^2 + 2 (9,8) (48) \checkmark$$

$$V_f = 30,86 \text{ m.s}^{-1} \checkmark$$

**OPTION 3****UPWARD POSITIVE/**

$$\Delta x = \frac{V_f + V_i}{2} \Delta t \checkmark$$

$$-(48) = \frac{V_f - 3,42}{2} \times 2,8 \checkmark$$

$$V_f = -30,87$$

$$V_f = 30,87 \text{ m.s}^{-1} \checkmark$$

**DOWNWARD POSITIVE /**

$$\Delta x = \frac{V_f + V_i}{2} \Delta t \checkmark$$

$$48 = \frac{V_f + 3,42}{2} \times 2,8 \checkmark$$

$$V_f = 30,87 \text{ m.s}^{-1} \checkmark$$



**OPTION 4**

$$mgh_1 + \frac{1}{2}mv_i^2 = mgh_2 + \frac{1}{2}mv_f^2 \quad \left. \vphantom{mgh_1} \right\} \text{Any one } \checkmark$$

$$gh_1 + \frac{1}{2}v_i^2 = gh_2 + \frac{1}{2}v_f^2 \quad \left. \vphantom{gh_1} \right\}$$

$$9,8 \times 48 + \frac{1}{2} \times 3,42^2 = 0 + \frac{1}{2}v_i^2 \quad \checkmark$$

$$V_f = 30,86 \text{ m.s}^{-1} \quad \checkmark$$

**OPTION 5**

$$\begin{aligned} F_{\text{net}} \Delta t &= \Delta p \\ F_{\text{net}} \Delta t &= m(v_f - v_i) \quad \left. \vphantom{F_{\text{net}}} \right\} \text{Any one } \checkmark \end{aligned}$$

$$mg\Delta t = m(v_f - v_i)$$

$$g\Delta t = v_f - v_i$$

$$9,8 \times 2,8 = v_f - 3,42 \quad \checkmark$$

$$V_f = 30,86 \text{ m.s}^{-1} \quad \checkmark$$

$$3.1.3 \quad V_f^2 = V_i^2 + 2a\Delta x \quad \checkmark$$

$$0 = v_i^2 + 2(9,8)(8) \quad \checkmark$$

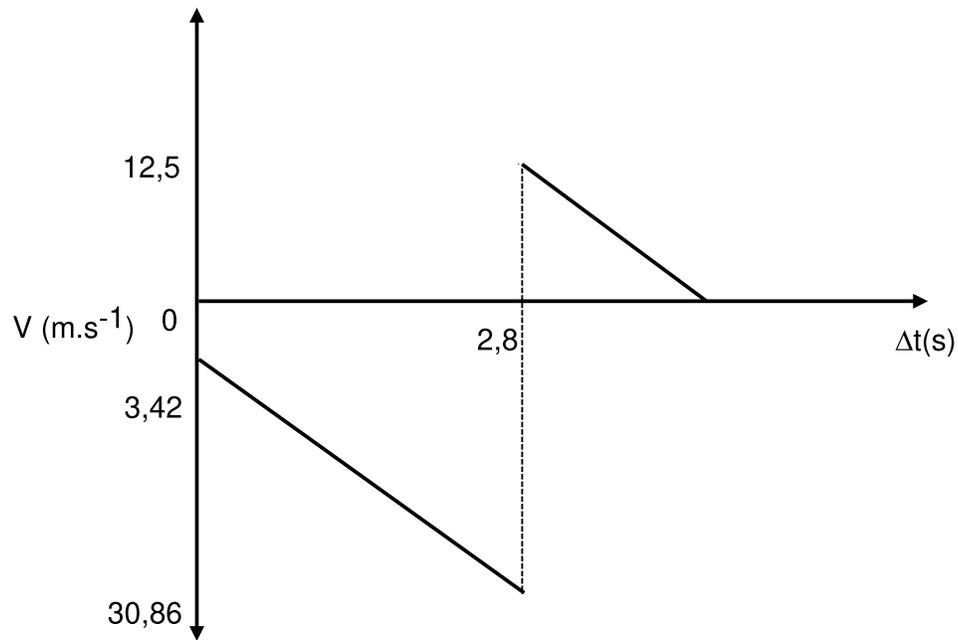
$$V_i = 15,68 \text{ m.s}^{-1} \quad \checkmark$$

(3)

**3.2 Positive marking from 3.1.1, 3.1.2, 3.1.3****CRITERIA FOR MARKING**

- (i) Initial velocity with which the ball was thrown.  $\checkmark$
- (ii) Final velocity with which the ball hit the ground  $\checkmark$
- (iii) Time taken to hit the ground.  $\checkmark$
- (iv) The velocity with which the ball bounces off the ground.  $\checkmark$





(4)  
[14]



**QUESTION 4 / VRAAG 4**

- 4.1 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)

4.2

$$\begin{aligned} \Sigma p \text{ before} &= \Sigma p \text{ after} && \} \checkmark \\ m_b \cdot v_{T+mb} + m_b \cdot v_T &= (m_b + m_T) \cdot v_f \\ \underline{100 \cdot 5 + 65 \cdot 0} &= \underline{(100 + 65) v_f} \\ v_f &= 3,03 \text{ m} \cdot \text{s}^{-1} \checkmark \end{aligned}$$

In same direction as the original direction of boat ✓

(5)

- 4.3  $F_{\text{NET}} \cdot \Delta t = \Delta p$  ✓  
 $F_{\text{NET}} \cdot 0,2 = 165 (0 - 3,03)$  ✓  
 $F_{\text{NET}} = -2499,75$  ✓  
 $F_{\text{NET}} = 2499,75 \text{ N}$  in opposite direction as boat ✓

(4)

**[11]**

**QUESTION 5**

5.1

NOTE: -1 Mark for each key word /phrase omitted in the correct context.

The net work done on an object is equal to the change in the object's kinetic energy. (2)

**OR**

The work done on an object by a net force is equal to the change in the object's kinetic energy.

5.2 **OPTION 1**

$$W_{\text{net}} = \Delta E_K$$

$$(F_g - f_f) \Delta x \cos \theta = E_{Kf} - E_{Ki} \quad \text{Any One } \checkmark$$

$$(F_g - f_f) \Delta x \cos \theta = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

$$[(80 \times 9,8) - 172] \times 4 \times (\cos 0^\circ) \checkmark = \frac{1}{2} (80) v_f^2 - \frac{1}{2} (80) (0)^2 \checkmark$$

$$v = 7,82 \text{ m} \cdot \text{s}^{-1} \checkmark$$

**OPTION 2**

$$W_{\text{net}} = \Delta E_K$$

$$W_f + W_{Fg} = E_{Kf} - E_{Ki}$$

$$f_f \Delta x \cos 180^\circ + F_g \Delta x \cos 0^\circ = E_{Kf} - E_{Ki} \quad \text{Any One } \checkmark$$

$$f_f \Delta x \cos 180^\circ + mg \Delta x \cos 0^\circ = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

$$172 \times 4 \times (-1) + (80)(9,8)(4)(1) \checkmark = \frac{1}{2} (80) v_f^2 - \frac{1}{2} (80) (0)^2 \checkmark$$

$$v = 7,82 \text{ m} \cdot \text{s}^{-1} \checkmark$$

**OPTION 3**

$$W_{\text{net}} = \Delta E_K$$

$$W_{Fg} + W_f = E_{Kf} - E_{Ki}$$

$$-\Delta E_p + W_f = E_{Kf} - E_{Ki}$$

$$-(mgh_f - mgh_i) + f_f \Delta x \cos 180^\circ = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2 \quad \text{Any One } \checkmark$$

$$-[(80)(9,8)(0) - (80)(9,8)(4)] + 172 \times 4 \times (-1) \checkmark = \frac{1}{2} (80) v_f^2 - \frac{1}{2} (80) (0)^2 \checkmark$$

$$v = 7,82 \text{ m} \cdot \text{s}^{-1} \checkmark$$

(4)



5.3 No ✓

The net work done by the non-conservative forces is not zero. ✓

**OR**

There is friction/non-conservative forces doing work. ✓

**OR**

It is not an isolated system. ✓

(2)

5.4 **OPTION 1**

$$E_{Mf} = E_{Mi} + W_{nc}$$

$$\left(\frac{mv_f^2}{2} + mgh_f\right) = \left(\frac{mv_i^2}{2} + mgh_i\right) + W_{nc}$$

$$\left(\frac{mv_f^2}{2} + mg(-d)\right) = \left(\frac{mv_i^2}{2} + mgh\right) + W_{nc}$$

$$\left(\frac{80 \times 0^2}{2} + 80 \times 9,8(-d)\right) \checkmark = \left[\left(\frac{80 \times 0^2}{2} + 80 \times 9,8 \times 4\right) + (-6240)\right] \checkmark$$

$$d = 3,96 \text{ m} \checkmark$$

✓ Any one

**OPTION 2**

$$W_{nc} = \Delta E_K + \Delta E_p \checkmark$$

$$W_{nc} = (E_{Kf} - E_{Ki}) + (E_{Pf} - E_{Pi})$$

$$W_{nc} = \left(\frac{mv_f^2}{2} - \frac{mv_i^2}{2}\right) - (mgh_f - mgh_i)$$

$$W_{nc} = \left(\frac{mv_f^2}{2} - \frac{mv_i^2}{2}\right) + (mg(-d) - mgh)$$

$$-6240 \checkmark = \left(\frac{80 \times 0^2}{2} - \frac{80 \times 0^2}{2}\right) + [80 \times 9,8 \times (-d) - (80 \times 9,8 \times 4)] \checkmark$$

$$d = 3,96 \text{ m} \checkmark$$

✓ Any one/Enige een

**OPTION 3**

$$W_{net} = \Delta E_K$$

$$W_c + W_{nc} = E_{Kf} - E_{Ki}$$

$$-\Delta E_p + W_{nc} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$-(E_{Pf} - E_{Pi}) + W_{nc} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$-[(mg(-d) - mgh)] + W_{nc} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$-[(80 \times 9,8(-d) - (80)(9,8)(4))] \checkmark + (-6240) = \frac{1}{2}80(0)^2 - \frac{1}{2}80(0)^2 \checkmark$$

$$d = 3,96 \text{ m} \checkmark$$

✓ Any one/Enige een



**OPTION 4**

$$W_{nc} = \Delta E_M$$

$$W_{nc} = E_{Mf} - E_{Mi} \checkmark$$

$$W_{nc} = (E_{Kf} - E_{Ki}) + (E_{Pf} - E_{Pi})$$

$$W_{nc} = \left( \frac{mv_f^2}{2} + mgh_f \right) - \left( \frac{mv_i^2}{2} + mgh_i \right)$$

$$W_{nc} = \left( \frac{v_f^2}{2} + mg(-d) \right) - \left( \frac{v_i^2}{2} + mgh \right)$$

$$\frac{80 \times 0^2}{2}$$

$$\frac{v_i^2}{2}$$

$$\frac{80 \times 0^2}{2}$$

✓ Any one/Enige een

$$-6240 \checkmark = \left[ \frac{v_f^2}{2} + 80 \times 9,8 \times (-d) \right] - \left[ \frac{80 \times 0^2}{2} + (80 \times 9,8 \times 4) \right]$$

$$d = 3,96 \text{ m} \checkmark$$

(4)

**[12]**

**QUESTION 6/VRAAG 6**

6.1 Doppler effect is 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. ✓

**OR**

The change in the observed frequency ✓ when there is relative motion between the source and the observer. ✓

(2)

6.2 Longer/Langer ✓

For the same (constant) speed of sound ✓ the frequency of sound is inversely proportional to the wave length and as the fire truck moves away from the listener the listener hears a lower frequency. ✓.

**OR**

Speed of sound is constant ✓, frequency detected (by the observer) is lower wavelenghts is inversely propotional to frequency. ✓

(3)

6.3  $f_L = \left( \frac{v \pm v_L}{v \pm v_s} \right) f_s$  ✓ **OR**  $f_L = \left( \frac{v}{v \pm v_s} \right) f_s$

Approaching

$$460 = \left( \frac{340}{340 - v_s} \right) f_s \checkmark$$

Moving away

$$410 = \left( \frac{340}{340 + v_s} \right) f_s \checkmark$$

Solving

$$460 = \left( \frac{340}{340 - v_s} \right) \left( \frac{410}{340 + v_s} \right)$$

$$v_s = 19,54 \text{ m} \cdot \text{s}^{-1}$$

$$460 \checkmark = \left( \frac{340}{340 - 19,54} \right) f_s \checkmark \quad \text{OR} \quad 410 \checkmark = \left( \frac{340}{340 + 19,54} \right) f_s \checkmark$$

(6)

$$f_s = 433,56 \text{ Hz} \checkmark$$

6.4 The star is moving away from the Erath ✓ because the spectrum shows a shifftowards the red end ✓ which is a lower frequency ✓

(3)



6.5 **ANY ONE**✓

- To measure rate of blood flow.
- Detect heartbeat of foetus.

**ENIGE EEN**

- Om die bloedvloeiempo te meet.
- Ontdek die hartklop van die fetus.

(1)  
**[15]**



**QUESTION 7/ VRAAG 7**

7.1.1 Positive ✓ (1)

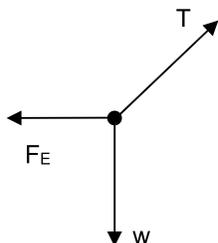
7.1.2  $F = \frac{kQ_1Q_2}{r^2}$  ✓

$$3,05 = \frac{(9 \times 10^9)(6 \times 10^{-6})Q}{0,2^2}$$

$$Q = 2,259 \times 10^{-6} \text{ C } \checkmark (2,26 \times 10^{-6} \text{ C})$$

(3)

7.1.3



Accepted labels	
w✓	Fg / Fw / weight / mg / gravitational force
T✓	FT / tension
FE✓	Electrostatic force/ Coulomb force/ F E Field

(3)

7.1.4

OPTION 1	OPTION 2
$F_{\text{net}} = 0$ $F_E = T \sin 10^\circ$ ✓ Any one $F_E = T \cos 80^\circ$ $3,05 = T \sin 10^\circ$ ✓ Any one $= T \cos 80^\circ$ $T = 17,56 \text{ N}$ ✓ (17,564 N)	$\frac{T}{\sin 90^\circ} = \frac{F_E}{\sin 10^\circ}$ ✓ $\frac{T}{1} = \frac{3,05}{\sin 10^\circ}$ ✓ $T = 17,56 \text{ N}$ ✓

(3)

7.2.1 The electric field at a point is the (electrostatic) force ✓ experienced per unit positive charge (2) placed at that point. ✓



7.2.2 Electric field at **M** due to **A** ( $+2 \times 10^{-5}$  C):

$$EA = \frac{KQ}{r^2}$$

$$= 9 \times 10^9 \cdot \frac{2 \times 10^{-5}}{(0,2)^2} \checkmark$$

$$= 4,5 \times 10^6 N, C^{-1} \text{To the left} \checkmark$$

Electric field at **M** due to **B** ( $4 \times 10^{-5}$  C):

$$EB = \frac{KQ}{r^2}$$

$$= 9 \times 10^9 \cdot \frac{4 \times 10^{-5}}{(0,2)^2} \checkmark$$

$$= 9 \times 10^6 N, C^{-1} \text{To the right} \checkmark$$

$$E_{\text{net at M}} = EA + EB$$

$$= (4,5 \times 10^6 + 9 \times 10^6) \checkmark \quad (6)$$

$$= 1,35 \times 10^7 N, C^{-1} \checkmark \text{To the right} \checkmark$$

[18]



**QUESTION 8/VRAAG 8**

8.1

**Marking criteria**

If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark.

The potential difference across a conductor is directly proportional to the current in the conductor at constant temperature (provided temperature and all other physical conditions are constant). ✓✓

**OR**

The ratio of potential difference to current is constant at constant temperature.

**OR**

The current in a conductor is directly proportional to the potential difference across the conductor at constant temperature (provided temperature and all other physical conditions are constant).

(2)

**NOTE**

Do not award the mark for addition of 4 if any other value is added to  $R_p$

8.2.1

**OPTION 1**

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

$$\frac{1}{R_p} = \frac{1}{1} + \frac{1}{5} \checkmark$$

$$R_p = 0,83 \Omega$$

$$R_T = 0,83 + 4 \checkmark$$

$$= 4,83 \Omega \checkmark$$

**OPTION 2**

$$R = \frac{R_1 R_2}{R_1 + R_2} \checkmark$$

$$R_p = \frac{(1)(5)}{1+5} \checkmark$$

$$R_p = 0,83 \Omega$$

$$R_T = 0,83 + 4 \checkmark$$

$$= 4,83 \Omega \checkmark$$

(4)



## 8.2.2 POSITIVE MARKING FROM QUESTION 8.2.1.

<p><b>OPTION 1</b></p> $R = \frac{V}{I} \checkmark$ $4,83 = \frac{V}{3,5} \checkmark$ $V = 16,91 \text{ V} \checkmark \quad (16,92 \text{ V})$	
<p><b>OPTION 2</b></p> $R_p = \frac{V_2}{I} \checkmark$ $0,83 = \frac{V_2}{3,5} \checkmark$ $V_2 = 2,91 \text{ V}$ $R_{4\Omega} = \frac{V_{4\Omega}}{I} \checkmark$ $4 = \frac{V_{4\Omega}}{3,5} \checkmark$ <p style="text-align: right;">Any one</p> $V_{4\Omega} = 14 \text{ V}$ $V_1 = V_2 + V_{4\Omega}$ $V_1 = 2,91 + 14$ $= 16,91 \text{ V} \checkmark \quad (16,92 \text{ V})$	(3)

8.2.3 Smaller than  $\checkmark$  (1)

8.3.1 **Marking criteria**  
 If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark.

Maximum work done by the battery per unit charge.  $\checkmark\checkmark$

**OR**

Maximum energy supplied by the battery per unit charge.

**OR**

The total amount of electric energy supplied by the battery per coulomb/per unit charge. (2)

8.3.2 No  $\checkmark$  (1)

8.3.3 The battery has internal resistance. ✓

**OR**

Some energy per coulomb of charge/volts is used to overcome internal resistance.

**OR**

There is a potential drop/lost volts inside the battery.

**OR**

$$\varepsilon = V_{\text{ext}} + V_{\text{int}}$$

**OR**

$$\varepsilon > V_{\text{ext}}$$

(1)

8.4.1 Decreases ✓

(1)

8.4.2 Increases ✓

(1)

**[16]**



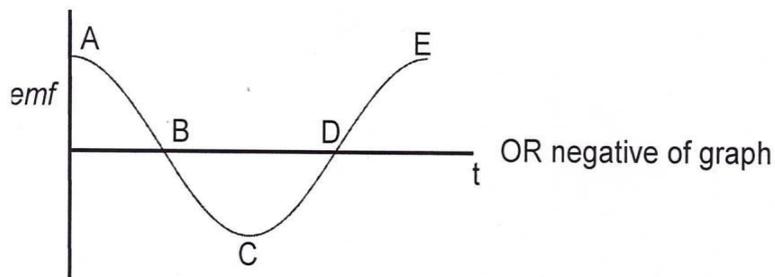
**QUESTION 9/VRAAG 9**

9.1.1 (Faraday's Law) of Electromagnetic Induction ✓ (1)

9.1.2 Mechanical energy (kinetic) is converted to electrical energy ✓ (1)

9.1.3 Slip rings connected to brushes ✓ (1)

9.1.4 9.1.1



• Shape ✓  
Max emf for A, C & E and Zero emf for B & D ✓ (2)

9.2

$$\begin{aligned}
 P_{ave} &= V_{rms} I_{rms} \\
 &= \frac{V_{max}}{\sqrt{2}} \cdot I_{rms} \\
 &= \left( \frac{35.36}{\sqrt{2}} \right) (1.22) \\
 &= 30.50 \text{ W}
 \end{aligned}$$

(4)  
**[9]**



Please turn over/Blaai om asseblief

SA EXAM  
PAPERS

**QUESTIONS 10/VRAAG 10**

10.1 Photoelectric effect. ✓ (1)

10.2 *It establishes the quantum theory✓ and it illustrates the particle nature of light.✓* (2)

10.3 The work function of a metal is the minimum energy that an electron in the metal needs to be emitted from the metal surface. ✓✓ (2)

10.4  $E_{kmax} = E - W_o$

$$E_{kmax} = \frac{hc}{\lambda} - W_o$$

} ✓ Any one

$$E_{kmax} = \frac{6,63 \times 10^{-34} \times 3 \times 10^8}{2 \times 10^{-7}} - 6,7 \times 10^{-19}$$

$$E_{kmax} = \frac{19,89 \times 10^{-26}}{2 \times 10^{-7}} - 6,7 \times 10^{-19}$$

$$E_{kmax} = 9,95 \times 10^{-19} \text{ J} - 6,7 \times 10^{-19} \text{ J}$$

$$E_{kmax} = 3,25 \times 10^{-19} \text{ J} \checkmark$$

(4)

10.5 Increases ✓

With light of higher intensity more photons strikes the metal surface per second✓

Thus more (photo) electrons are emitted per second, ✓resulting in a bigger current.

(3)

10.6 REMAINS THE SAME (1)

**[13]****TOTAL: 150**