



Province of the  
**EASTERN CAPE**  
EDUCATION

**NATIONAL  
SENIOR CERTIFICATE/  
NASIONALE SENIOR  
SERTIFIKAAT**

**GRADE/IBANGA 12**

**SEPTEMBER 2021**

**PHYSICAL SCIENCES P1/INZULULWAZI P1  
MARKING GUIDELINE/ISIKHOKELO  
SOKUMAKISHA**

**MARKS/AMANQAKU 150**

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This marking guideline consists of 17 pages./  
*Esi sikhokelo sokumakisha sinamaphepha ali17.*

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**GENERAL GUIDELINES/IMIQATHANGO EQHELEKILEYO****1. CALCULATIONS/UKUBALA**

- 1.1 **Marks will be awarded for:** correct formula, correct substitution, correct answer with unit.  
*Amanqaku ayakunikelwa ifomyula echanekileyo, ukufakela izimeli, iimpendulo ezichanekileyo ezineyunithi.*
- 1.2 **No marks** will be awarded if an **incorrect or inappropriate formula is used**, even though there are many relevant symbols and applicable substitutions.  
*Akukho manqaku azakunikwa ukuba kusetyenziswe ifomyula engeyiyo, nangona kukho iisimboli nezimeli ezizizo.*
- 1.3 When an error is made during **substitution into a correct formula**, a mark will be awarded for the correct formula and for the correct substitutions, but **no further marks** will be given.  
*Xa kwenzeka impazamo ekufakelweni kwezimeli kwifomyula echanekileyo, likhona inqaku elinganikelwa ifomyula nezimeli ezichanekileyo kodwa awakho amanye amanqaku anikwayo.*
- 1.4 If **no formula** is given, but **all substitutions are correct**, a candidate will **forfeit one mark**.  
*Ukuba akukho fomyula inikiweyo, kodwa zonke izimeli zichanekile, umlingwa uyakulahlekelwa linqaku.*
- 1.5 **No penalisation** if **zero substitutions are omitted** in calculations where **correct formula/principle** is correctly given.  
*Akuyi kuxhuzulwa manqaku ukuba izimeli zika zero zishiyelwe kwizibalo apho ifomyula/umgaqo uchanekileyo.*
- 1.6 Mathematical manipulations and change of subject of appropriate formulae carry no marks, but if a candidate starts off with the correct formula and then changes the subject of the formula incorrectly, marks will be awarded for the formula and correct substitutions. The mark for the incorrect numerical answer is forfeited.  
*Uhlengahlengiso lwezibalo notshintsho lwesubject kwifomyula ezizizo alunamanqaku, kodwa ukuba umlingwa uqale ngefomyula echanekileyo ze watshintsha isubject yefomyula ngokuphosakeleyo, amanqaku ayakunikelwa ifomyula nezimeli ezichanekileyo. Inqaku lempendulo engachanekanga liyakumphosa.*
- 1.7 Marks are only awarded for a formula if a **calculation has been attempted**, i.e. substitutions have been made or a numerical answer given.  
*Amanqaku anikelwa ifomyula kuphela xa isibalo sizanyiwe, izimeli zifakiwe okanye impendulo elinani inikiwe.*

- 1.8 Marks can only be allocated for substitutions when values are substituted into formulae and not when listed before a calculation starts.  
*Amanqaku ayakunikezelwa kuphela ukuba amaxabiso afakiwe kwifomyula kwaye azidweliswanga nje phambi kokubala.*
- 1.9 All calculations, when not specified in the question, must be done to a minimum of two decimal places.  
*Zonke izibalo ukuba akuqononondiswanga kumbuzo, mazenziwe zibenamaqondo amabini edesimali .*
- 1.10 If a final answer to a calculation is correct, full marks will not automatically be awarded. Markers will always ensure that the correct/appropriate formula is used and that workings, including substitutions, are correct.  
*Ukuba impendulo yokugqibela ichanekile, amanqaku apheleleyo awakusuka anikelwe. Abamakishi bakuqinisekisa ukuba ifomyula echanekileyo isetyenzisiwe kwaye umsebenzi kunye nezimeli zichanekile.*
- 1.11 Questions where a series of calculations have to be made (e.g. a circuit diagram question) do not necessarily always have to follow the same order. FULL MARKS will be awarded provided it is a valid solution to the problem. However, any calculation that will not bring the candidate closer to the answer than the original data, will not count any marks.  
*Kwimibuzo apho kulindeleke uhloho lwezibalo (umz. Umbuzo wecircuit diagram) akunyanzelekanga lulandelelwano lunye. AMANQAKU APHELELEYO ayakunikwa ukuba sisisombululo esisiso kumbuzo. Nasiphi na isibalo esingamsondeziyo umlingwa kwimpendulo echanekileyo asiyi kunikwa manqaku.*

## 2. UNITS//IYUNITHI

- 2.1 Candidates will only be penalised once for the repeated use of an incorrect unit **within a question**.  
*Abalingwa bayakuhluthelwa amanqaku kube kanye ukuba bathe gqolo besebenzisa iyunithi engachanekanga **kumbuzo lowo**.*
- 2.2 Units are only required in the final answer to a calculation.  
*Iyunithi zilindeleke kwimpendulo yokugqibela yesibalo.*
- 2.3 Marks are only awarded for an answer, and not for a unit *per se*. Candidates will therefore forfeit the mark allocated for the answer in each of the following situations:
- Correct answer + wrong unit
  - Wrong answer + correct unit
  - Correct answer + no unit
- Amanqaku anikezelwa impendulo, hayi iyunithi. Umlingwa ke ngoko uyakulahlekelwa ngamanqaku kwezi meko ziladelayo:*
- *Impendulo echanekileyo + iyunithi ephosakeleyo*
  - *Impendulo engachanekanga + iyunithi echanekileyo*
  - *Impendulo echanekileyo + iyunithi eshiyelelweyo/engekhoyo*

- 2.4 SI units must be used except in certain cases, e.g.  $V \cdot m^{-1}$  instead of  $N \cdot C^{-1}$ , and  $cm \cdot s^{-1}$  or  $km \cdot h^{-1}$  instead of  $m \cdot s^{-1}$  where the question warrants this.  
*SI-yunithi mazisetyenziswe, ngaphandle kwa kwezi meko, umz.  $V \cdot m^{-1}$  endaweni ka  $N \cdot C^{-1}$ , kunye no  $cm \cdot s^{-1}$  ka  $km \cdot h^{-1}$  endaweni ka  $m \cdot s^{-1}$  kodwa umbuzo uyakungqina oku.*

### 3. GENERAL/OKUQHELEKILEYO

- 3.1 If one answer or calculation is required, but two are given by the candidate, only the first one will be marked, irrespective of which one is correct. If two answers are required, only the first two will be marked, etc.  
*Ukuba kulindeleke impendulo okanye isibalo esinye ze umlingwa anike zibembini, kuyakuqwalaselwa kuphela le yokuqala nokuba yeyiphi kuzo echanekileyo. Ukuba kulindeleke iimpindulo ezimbini, kuyakuqwalaselwa kuphela isibini sokuqala.*
- 3.2 For marking purposes, alternative symbols (s, u, t, etc.) will also be accepted.  
*Ukwenzela ukumakisha, ezinye iisimboli (s, u, t, ens.) ziyakwamkeleka.*
- 3.3 Separate compound units with a multiplication dot, not a full stop, for example,  $m \cdot s^{-1}$ .  
 For marking purposes,  $m \cdot s^{-1}$  and m/s will also be accepted.  
*Yohlula iiyunithi ezidityanisiweyo ngemultiplication dot. Hayi isingxi, umz.  $m \cdot s^{-1}$ . Ukwenzela ukumakisha, u  $m \cdot s^{-1}$  no m/s bayakwamkeleka nabo.*

### 4. POSITIVE MARKING



Positive marking regarding calculations will be followed in the following cases:  
*Positive marking malunga nezibalo iyakulandelwa kwezi meko zilandelayo:*

- 4.1 **Sub-question to sub-question:** When a certain variable is calculated in one sub-question (e.g. 3.1) and needs to be substituted in another (3.2 of 3.3), e.g. if the answer for 3.1 is incorrect and is substituted correctly in 3.2 or 3.3, **full marks** are to be awarded for the subsequent sub-questions.  
***Umbuzwana ukuya kumbuzwana:*** xa ivariable ethile ibalwe kumbuzwana omnye (umz. 3.1) kwaye idinga ukufakelwa kwenye (3.2 okanye 3.3), umz. ukuba impendulo ka 3.1 ayichanekanga ibe ifakelwe kakuhle ku 3.2 okanye 3.3, **amanqaku apheleleyo** ayaunikelwa umbuzwana olandelayo.
- 4.2 **A multistep question of a sub-question:** If the candidate has to calculate, for example, current in die first step and gets it wrong due to a substitution error, the mark for the substitution and the final answer will be forfeited.  
***Umbuzo onamanqanaba amaninzi wombuzwana:*** Uba umlingwa ufanele abale. umz. Umsinga kwibakala lokuqala aze aliphose ngenxa yezimeli ezingachanekanga, inqaku lesimeli nelempendulo yokugqibela ziyakumphosa.

**5. NEGATIVE MARKING**

Normally an incorrect answer cannot be correctly motivated if based on a conceptual mistake. If the candidate is therefore required to motivate in QUESTION 3.2 the answer given in QUESTION 3.1, and QUESTION 3.1 is incorrect, no marks can be awarded for QUESTION 3.2. However, if the answer for e.g. QUESTION 3.1 is based on a calculation, the motivation for the incorrect answer could be considered. *Ngokwesiqhelo impendulo engachanekanga ayithetheleleki isekelezelwe kwingcamangao enempazamo. Ukuba umlingwa ulindeleke ukuba acacise/asekele kuMBUZO 3.2 impendulo abeyinike ku MBUZO 3.1, ube loMBUZO 3.1 ungachanekanga, akukho manqaku azakunikelwa uMBUZO 3.2. Ukuba impendulo ekuMBUZO 3.1 isekelezelwe ekubaleni, imotivation yempendulo engachanekanga ingajongwa.*



**QUESTION/UMBUZO 1: MULTIPLE-CHOICE QUESTIONS/ IMIBUZO  
EKHETHISAYO**

- 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]**



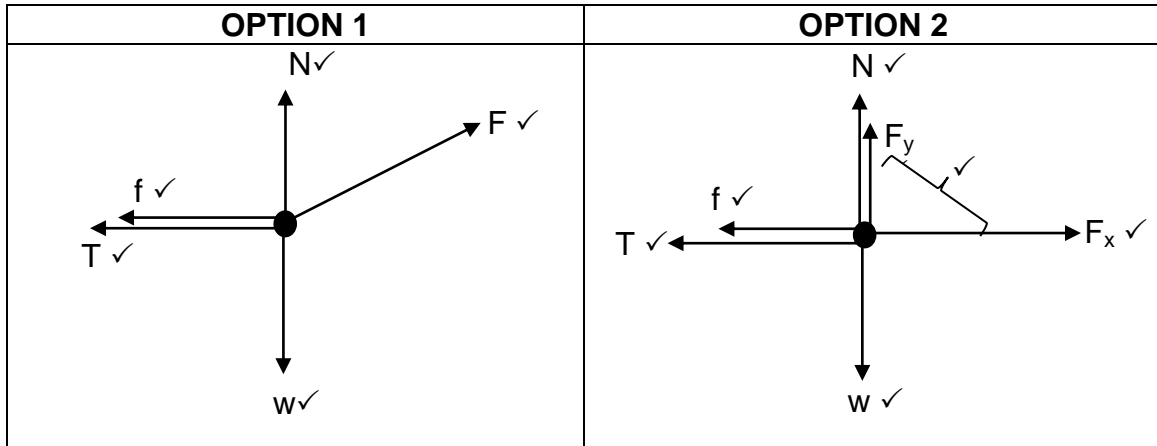
**QUESTION/UMBUZO 2**

2.1.1 When a (non-zero) resultant/net force acts on an object, it accelerates in the direction of the force. The acceleration is directly proportional to the force and inversely proportional to the mass of the object. ✓✓

Xa i(non-zero) resultant/net force isebenza kwi object, ibalekela kwicala leforce. *Isantya si directly proportional kwiforce kwaye si inversely proportional kubunzima be object* ✓✓

(2)

2.1.2



(5)

Accept the following symbols./yamkela ezi simboli zilandelayo:	
N ✓	$F_N$ /Normal/eqhelekileyo/Normal force/amandla aqhelekileyo
f ✓	$F_f$ / $f_k$ / $f_r$ / frictional force / kinetic frictional force /
w ✓	$F_g$ , mg/weight/ $F_{\text{Earth on block}}$ /49 N/gravitational force/
T ✓	Tension / $F_T$
$F_{\text{applied}}$ ✓	F / Applied force

Marks awarded for arrow and label/*amanqaku anikelwa itolo negama.*  
 Do not penalise for length of arrows since drawing is not drawn to scale.  
*Sukuhlutha manqaku ukuba itolo lifutshane/lide (umzobo awenziwanga ngokweskali).*

Any other additional force(s)  $\frac{3}{4}$

If force(s) do not make contact with body. Max./Maks.  $\frac{3}{4}$

*Ukuba iiforce aziyichananga/aziyithintanga iobject.*

2.1.3	<b>OPTION 1</b> (To the right is positive) (ukuya ekunene positive)	<b>OPTION 2</b> (To the right is negative) (ukuya ekunene inegative)
	$F_{\text{net}} = ma$ $T - f = ma$ $F \cos \theta - T - f = ma$ $T - 10 = 2(2) \checkmark$ $T = 14 \text{ N}$ $F \cos \theta - T - f = ma$ $F \cos 20^\circ - 14 - 15 \checkmark = 5(2) \checkmark$ $F = 41,50 \text{ N} \checkmark$	$F_{\text{net}} = ma$ $f - T = -ma$ $T + f - F \cos \theta = -ma$ $10 - T = 2(-2) \checkmark$ $T = 14 \text{ N}$ $T + f - F \cos \theta = -ma$ $14 + 15 - F \cos 20^\circ \checkmark = 5(-2) \checkmark$ $F = 41,50 \text{ N} \checkmark$

(5)

$$2.2 \quad F = \frac{Gm_1m_2}{d^2} \checkmark$$

$$1\,842,50 \checkmark = \frac{(6,67 \times 10^{-11})(5,98 \times 10^{24})(200)}{d^2} \checkmark$$

$$d = 6\,579\,982,80 \text{ m}$$

distance above earth surface/umgama ngaphezu komhlaba =

$$6\,579\,982,80 - 6,38 \times 10^6 \checkmark$$

$$= 199\,982,80 \text{ m} (1,9998280 \times 10^5 \text{ m} / 2,00 \times 10^5 \text{ m}) \checkmark$$

(5)  
[17]

### QUESTION/UMBUZO 3

#### 3.1.1 OPTION 1

<b>UPWARDS POSITIVE</b> <b>UKUNYUKA POSITIVE</b>	<b>UPWARDS NEGATIVE</b> <b>UKUNYUKA NEGATIVE</b>
$v_f^2 = v_i^2 + 2a\Delta y \checkmark$ $(-25)^2 = (-20)^2 + 2(-9,8) \Delta y \checkmark$ $\Delta y = -11,48$ $\Delta y = 11,48 \text{ m} \checkmark$	$v_f^2 = v_i^2 + 2a\Delta y \checkmark$ $(25)^2 = (20)^2 + 2(9,8) \Delta y \checkmark$ $\Delta y = 11,48 \text{ m} \checkmark$

#### OPTION 2

<b>UPWARDS POSITIVE</b> <b>UKUNYUKA POSITIVE</b>	<b>UPWARDS NEGATIVE</b> <b>UKUNYUKA NEGATIVE</b>
$v_f = v_i + a\Delta t$ $-25 = -20 + (-9,8)(\Delta t)$ $\Delta t = 0,51 \text{ s}$ $\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2 \checkmark$ $\Delta y = (-20)(0,51) + \frac{1}{2}(-9,8)(0,51)^2 \checkmark$ $\Delta y = -11,47$ $\Delta y = 11,47 \text{ m} \checkmark$	$v_f = v_i + a\Delta t$ $25 = 20 + (9,8)(\Delta t)$ $\Delta t = 0,51 \text{ s}$ $\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2 \checkmark$ $\Delta y = (20)(0,51) + \frac{1}{2}(9,8)(0,51)^2 \checkmark$ $\Delta y = 11,47 \text{ m} \checkmark$



OPTION 3	
UPWARDS POSITIVE UKUNYUKA POSITIVE	UPWARDS NEGATIVE UKUNYUKA NEGATIVE
$v_f = v_i + a\Delta t$ $-25 = -20 + (-9,8)(\Delta t)$ $\Delta t = 0,51 \text{ s}$ $\Delta y = \frac{v_f + v_i}{2} \Delta t \checkmark$ $\Delta y = \frac{-25 + (-20)}{2} \times 0,51 \checkmark$ $\Delta y = -11,48 \text{ m}$ $\Delta y = 11,48 \text{ m} \checkmark$	$v_f = v_i + a\Delta t$ $25 = 20 + (9,8)(\Delta t)$ $\Delta t = 0,51 \text{ s}$ $\Delta y = \frac{v_f + v_i}{2} \Delta t \checkmark$ $\Delta y = \frac{25 + 20}{2} \times 0,51 \checkmark$ $\Delta y = 11,48 \text{ m} \checkmark$

OPTION 4 (ACCEPT/YAMKELA)	
UPWARDS POSITIVE UKUNYUKA POSITIVE	UPWARDS NEGATIVE UKUNYUKA NEGATIVE
$v_f = v_i + a\Delta t$ $-25 = -20 + (-9,8)(\Delta t)$ $\Delta t = 0,51 \text{ s}$ $\Delta y = lb + \frac{1}{2}bh \checkmark$ $\Delta y = 20 \times 0,51 + \frac{1}{2}(5)0,51 \checkmark$ $\Delta y = 11,48 \text{ m} \checkmark$	$v_f = v_i + a\Delta t$ $25 = 20 + (-9,8)(\Delta t)$ $\Delta t = 0,51 \text{ s}$ $\Delta y = lb + \frac{1}{2}bh \checkmark$ $\Delta y = 20 \times 0,51 + \frac{1}{2}(5)0,51 \checkmark$ $\Delta y = 11,48 \text{ m} \checkmark$

(3)

3.1.2

UPWARDS POSITIVE UKUNYUKA POSITIVE	UPWARDS NEGATIVE UKUNYUKA NEGATIVE
$v_f = v_i + a\Delta t \checkmark$ $-25 = -20 + (-9,8)(\Delta t) \checkmark$ $\Delta t = 0,51 \text{ s}$ (time to reach to ground) <i>(ixesha ukuya kufika emhlabeni)</i> $v_f = v_i + a\Delta t$ $0 = 12 + (-9,8)(\Delta t) \checkmark$ $\Delta t = 1,22 \text{ s}$ (time to reach maximum height) <i>(ixesha ukufika phezulu)</i> $t = 1,22 + 0,51 \checkmark$ $t = 1,73 \text{ s} \checkmark$	$v_f = v_i + a\Delta t \checkmark$ $25 = 20 + (-9,8)(\Delta t) \checkmark$ $\Delta t = 0,51 \text{ s}$ (time to reach to ground) <i>(ixesha ukuya kufika emhlabeni)</i> $v_f = v_i + a\Delta t$ $0 = -12 + (9,8)(\Delta t) \checkmark$ $\Delta t = 1,22 \text{ s}$ (time to reach maximum height) <i>(ixesha ukufika phezulu)</i> $t = 1,22 + 0,51 \checkmark$ $t = 1,73 \text{ s} \checkmark$

(5)

3.1.3

OPTION 1	
Positive marking from 3.1.1	
UPWARDS POSITIVE UKUNYUKA POSITIVE	UPWARDS NEGATIVE UKUNYUKA NEGATIVE
$v_f^2 = v_i^2 + 2a\Delta y \checkmark$ $0^2 = 12^2 + 2(-9,8) \Delta y \checkmark$ $\Delta y = 7,35 \text{ m}$ Displacement = $\frac{-11,48}{2} + 7,35 \checkmark$ $= -4,13$ $= 4,13 \text{ m}$ (downwards/ukuhla) $\checkmark$	$v_f^2 = v_i^2 + 2a\Delta y \checkmark$ $0^2 = -12^2 + 2(9,8) \Delta y \checkmark$ $\Delta y = -7,35 \text{ m}$ Displacement = $\frac{11,48}{2} + (-7,35) \checkmark$ $= 4,13 \text{ m}$ (downwards/ukuhla) $\checkmark$

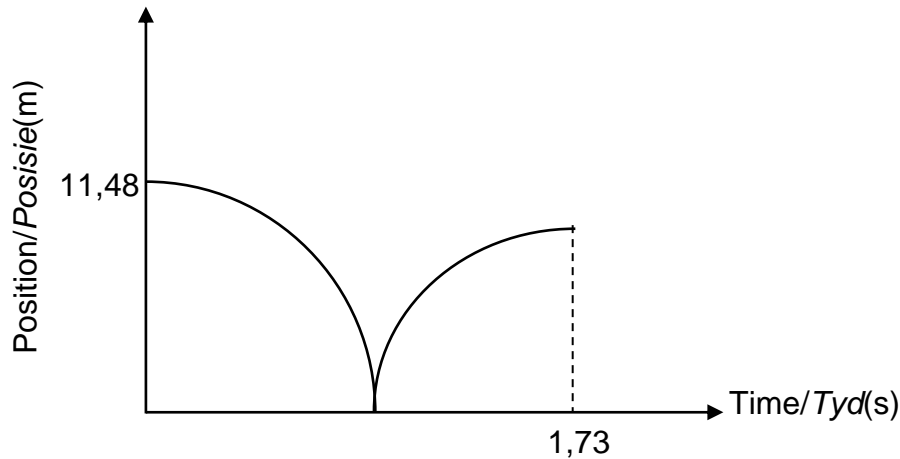
OPTION 2	
Positive marking from 3.1.1	
UPWARDS POSITIVE UKUNYUKA POSITIVE	UPWARDS NEGATIVE UKUNYUKA NEGATIVE
$v_f = v_i + a\Delta t$ $0 = 12 + (-9,8)(\Delta t)$ $\Delta t = 1,22 \text{ s}$ $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark$ $\Delta y = 12 \times 1,22 + \frac{1}{2}(-9,8)(1,22)^2 \checkmark$ $\Delta y = 7,35 \text{ m}$ Displacement = $\frac{-11,48}{+7,35} \checkmark$ $= -4,13$ $= 4,13 \text{ m}$ (downwards/ukuhla) $\checkmark$	$v_f = v_i + a\Delta t$ $0 = -12 + (9,8)(\Delta t)$ $\Delta t = 1,22 \text{ s}$ $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark$ $\Delta y = (-12)(1,22) + \frac{1}{2}(9,8)(1,22)^2 \checkmark$ $\Delta y = -7,35$ Displacement = $\frac{11,48}{+(-7,35)} \checkmark$ $= 4,13 \text{ m}$ (downwards/ukuhla) $\checkmark$

OPTION 3	
Positive marking from 3.1.1	
UPWARDS POSITIVE UKUNYUKA POSITIVE	UPWARDS NEGATIVE UKUNYUKA NEGATIVE
$v_f = v_i + a\Delta t$ $0 = 12 + (-9,8)(\Delta t)$ $\Delta t = 1,22 \text{ s}$ $\Delta y = \frac{v_f + v_i}{2} \Delta t \checkmark$ $\Delta y = \frac{0 + (12)}{2} \times 1,22 \checkmark$ $\Delta y = 7,32 \text{ m}$ Displacement = $\frac{-11,48}{+7,32} \checkmark$ $= -4,16$ $= 4,16 \text{ m}$ (downwards/ukuhla) $\checkmark$	$v_f = v_i + a\Delta t$ $0 = -12 + (9,8)(\Delta t)$ $\Delta t = 1,22 \text{ s}$ $\Delta y = \frac{v_f + v_i}{2} \Delta t \checkmark$ $\Delta y = \frac{0 + (-12)}{2} \times 1,22 \checkmark$ $\Delta y = -7,32 \text{ m}$ Displacement = $\frac{11,48}{+(-7,32)} \checkmark$ $= 4,16 \text{ m}$ (downwards/ukuhla) $\checkmark$

OPTION 4	
Positive marking from 3.1.1	
UPWARDS POSITIVE UKUNYUKA POSITIVE	UPWARDS NEGATIVE UKUNYUKA NEGATIVE
$v_f = v_i + a\Delta t$ $0 = 12 + (-9,8)\Delta t$ $\Delta t = 1,22 \text{ s}$ Area = $\frac{1}{2}bh \checkmark$ $= \frac{1}{2}(1,22)(12) \checkmark$ $= 7,32 \text{ m}$ Displacement = $\frac{-11,48}{+7,32} \checkmark$ $= -4,16$ $= 4,16 \text{ m (downwards/ukuhla)} \checkmark$	$v_f = v_i + a\Delta t$ $0 = -12 + (9,8)\Delta t$ $\Delta t = 1,22 \text{ s}$ Area = $\frac{1}{2}bh \checkmark$ $= \frac{1}{2}(1,22)(-12) \checkmark$ $= -7,32 \text{ m}$ Displacement = $\frac{11,48}{+(-7,32)} \checkmark$ $= 4,16 \text{ m}$ (downwards/ukuhla) $\checkmark$

(4)

3.2 Positive marking from 3.1.1 and 3.1.2



CRITERIA FOR MARKING/	
Correct shape/ishape echanekileyo	✓
Height indicated/umphakamo ubonisiwe (11,48 m)	✓
Time t indicated/ixesha t libonisiwe (1,73 s)	✓

(3)  
[15]

QUESTION/UMBUZO 4

4.1 In an isolated system total linear momentum is conserved. ✓✓ (2)

4.2.1  $\sum p_i = \sum p_f$   
 $m_A v_{iA} + m_B v_{iB} = (m_A + m_B) v_f$  } Any one/nayiphi ✓  
 $(2 \times v_{iA}) + (4 \times -5) \checkmark = (2+4)(-1,67) \checkmark$   
 $v_{iA} = 4,99 \text{ m}\cdot\text{s}^{-1} \text{ (East/Empuma)} \checkmark$  (4)

POSITIVE MARKING FROM 4.2.1		POSITIVE MARKING FROM 4.2.1	
OPTION 1		OPTION 2	
$F_{\text{net}} \cdot \Delta t = \Delta p$	Any one /nayiphi ✓	$F_{\text{net}} \cdot \Delta t = \Delta p$	Any one /nayiphi ✓
$F_{\text{net}} \cdot \Delta t = m(v_f - v_i)$		$F_{\text{net}} \cdot \Delta t = m(v_f - v_i)$	
$F_{\text{net}} \times 0,01 \checkmark = 2 (-1,67 - 4,99) \checkmark$		$F_{\text{net}} \times 0,01 \checkmark = 2 [1,67 - (-4,99)] \checkmark$	
$F_{\text{net}} = -1\,332 \text{ N}$		$F_{\text{net}} = -1\,332 \text{ N}$	
$F_{\text{net}} = \underline{1\,332 \text{ N west/left/entshona kwesokunxele}} \checkmark$		$F_{\text{net}} = \underline{1\,332 \text{ N west/entshona}} \checkmark$	

OPTION 3	OPTION 4
$F_{\text{net}} = ma$ $F_{\text{net}} = m \left( \frac{v_f - v_i}{\Delta t} \right)$ $F_{\text{net}} = 2 \times \left( \frac{-1,67 - 4,99}{0,01} \right)$ $F_{\text{net}} = -1\ 332$ $F_{\text{net}} = \underline{1\ 332\ \text{N}}$ <u>west/left/entshona/kwesokunxele</u> ✓	$F_{\text{net}} = ma$ $F_{\text{net}} = m \left( \frac{v_f - v_i}{\Delta t} \right)$ $F_{\text{net}} = 2 \times \left( \frac{1,67 - (-4,99)}{0,01} \right)$ $F_{\text{net}} = \underline{1\ 332\ \text{N west/}}$ <u>entshona/kwesokunxele</u> ✓

OPTION 5/OPSIE 5	OPTION 6/OPSIE 5
$F_{\text{net}} \cdot \Delta t = \Delta p$ $F_{\text{net}} \cdot \Delta t = m(v_f - v_i)$ $F_{\text{net}}(0,01) \checkmark = 4(-1,67 - -5) \checkmark$ $F_{\text{net}} = 1\ 332$ $F_{\text{AB}} = - F_{\text{BA}}$ $F_{\text{net(BA)}} = \underline{1\ 332\ \text{N west/left}}$ ✓	$F_{\text{net}} \cdot \Delta t = \Delta p$ $F_{\text{net}} \cdot \Delta t = m(v_f - v_i)$ $F_{\text{net}}(0,01) \checkmark = 4(1,67 - 5) \checkmark$ $F_{\text{net}} = -1\ 332$ $F_{\text{AB}} = - F_{\text{BA}}$ $F_{\text{net(BA)}} = \underline{1\ 332\ \text{N west/left}}$ ✓

(4)  
[10]

## QUESTION/UMBUZO 5



5.1 Gravitational force ✓

(1)

5.2  $\Delta x = \frac{12}{\sin 30^\circ} \checkmark = 24\ \text{m}$ 

$$W_f = f \cdot \Delta x \cos \theta \checkmark$$

$$W_f = 35,5 \times 24 \cos 180^\circ \checkmark$$

$$W_f = -852\ \text{J} \checkmark$$

(4)

5.3 Zero/0 J ✓

(1)

## 5.4 Positive marking from 5.2

**OPTION 1**

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

$$W_f + W_F + W_{Fg} = \Delta E_k$$

$$f \times \Delta x \cos \theta + F \Delta x \cos \theta + mg(h_2 - h_1) = \Delta E_k$$

$$-852 \checkmark + (62,5 \times 24 \cos 180^\circ) \checkmark + m(9,8)(12-0) \checkmark = 0$$

$$m = 20 \text{ kg } \checkmark$$

Any one/nayiphi ✓

**OPTION 2**

$$W_{\text{nc}} = \Delta E_p + \Delta E_k$$

$$W_f + W_F = \Delta E_p + \Delta E_k$$

$$f \Delta x \cos \theta + F \Delta x \cos \theta = mg(h_2 - h_1) + \Delta E_k$$

$$-852 \checkmark + (62,5)(24)\cos 180^\circ \checkmark = m(9,8)(0 - 12) \checkmark + 0$$

$$m = 20 \text{ kg } \checkmark$$

Any one/nayiphi

**OPTION 3**

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

$$W_f + W_F + W_w = \Delta E_k$$

$$f \Delta x \cos \theta + F \Delta x \cos \theta + mg \Delta x \cos \theta = \Delta E_k$$

$$-852 \checkmark + (62,5)(24)\cos 180^\circ \checkmark + m(9,8)(24)\cos 60^\circ \checkmark = 0$$

$$m = 20 \text{ kg } \checkmark$$

Any one/nayiphi ✓

(5)  
[11]**QUESTION/UMBUZO 6**6.1.1 520 Hz / 520 waves per second (waves.s<sup>-1</sup>) ✓

(1)

6.1.2 The change in frequency ✓ (or pitch) observed/detected by a listener because the listener and the sound source have different velocities relative to the medium of sound propagation. ✓**OR/OKANYE**The (apparent) changed in observed/detected frequency (pitch) as a result of relative motion between the sound source and the listener. ✓ ✓

(2)

6.1.3 TOWARDS ✓ Detected frequency is higher than the source frequency ✓

(2)

$$f_L = \frac{v \pm v_L}{v \pm v_s} f_s \checkmark$$

$$520 \checkmark = \frac{343}{343 - v_s} \checkmark (480) \checkmark$$

$$v_s = 26,38 \text{ m} \cdot \text{s}^{-1} \checkmark$$

(5)

6.1.5 Decreases/lyehla ✓

For a constant velocity/speed of sound, if the frequency increases,  $\lambda$  decreases. ✓

**OR**

$\lambda \propto \frac{1}{f}$  at constant velocity/speed ✓

**OR f**

$\propto \frac{1}{\lambda}$  at constant velocity/speed ✓ (2)

6.2 Light from the star is shifted towards longer wavelength (towards the red end of the spectrum) ✓ (2)

6.3 Used to measure the direction and speed of blood flow in arteries and veins. ✓  
*Isetyenziselwa ukubona apho igazi liya khona nesantya elihamba ngaso emithanjeni*

**OR/OKANYE**

Used to measure the heartbeat of a foetus in the womb.

*isetyenziselwa ukujonga ukubetha kwentliziyo yosana olusesibelekweni*

(1)  
**[15]**

### QUESTION/UMBUZO 7

7.1.1 GAIN/IFUNYENWE ✓

(1)

7.1.2  $n = \frac{Q}{q_e}$  ✓

$n = \frac{5 \times 10^{-6}}{1,6 \times 10^{-19}}$  ✓

$n = 3,125 \times 10^{13}$  (electrons) ✓



(3)

7.1.3  $E = \frac{kQ}{r^2}$  ✓

$E = \frac{9 \times 10^9 \times 5 \times 10^{-5}}{0,1^2}$  ✓

$E = 4,5 \times 10^6 \text{ N.C}^{-1}$  ✓ left/ekunxele ✓

(5)

7.2.1 Negative ✓

Like charges repel each other/Ezifanayo ziyakhabana. ✓

**OR/OKANYE**

The charges repel each other. If sphere **A** is negative, then sphere **B** must also be negative. ✓

*icharges ziyakhabana. Ukuba usphere A unegative, ngoko usphere B naye makabe negative.*

(2)

$$7.2.2 \quad F_E = T \sin 30^\circ$$

$$F_E = 25 \sin 30^\circ \checkmark$$

$$F_E = 12,5 \text{ N}$$

$$F_E = \frac{kQ_1 Q_2}{r^2} \checkmark$$

$$12,5 \checkmark = \frac{(9 \times 10^9)(5 \times 10^{-6}) Q}{0,05^2} \checkmark$$

$$Q = 6,94 \times 10^{-7} \text{ C} \checkmark$$

(6)  
[17]**QUESTION/UMBUZO 8**

8.1.1 Temperature/*ubushushu* ✓  
 Length of the conductors/*ubude becoductors* ✓ (Any two/*nasiphi isibini*)  
 Thickness of the conductors/*ukutyeba kweconductors*.  
 ACCEPT: Type of material  
 YAMKELA: *uhlobo lwematerial* (2)

8.1.2 Gradient is the inverse of the resistance. ✓/  
**OR**  
 Gradient =  $\frac{1}{R}$  ✓ (1)

8.1.3 Conductor C./*Geleier C.* ✓  
 It has the highest resistance. The higher the resistance of a conductor, the more heat is produced in the conductor if the current is constant. ✓ (2)

8.2.1  $R = \frac{V}{I}$  ✓  
 $R = \frac{12}{1,5}$  ✓  
 $R = 8 \Omega$  ✓ (3)

8.2.2 **OPTION 1** **OPTION 2**  
 $R_{\text{total}} = R + r$  ✓  $\varepsilon = I(R + r)$  ✓  
 $[8 = (4 + 3) + r]$  ✓  $12 = 1,5 [(4 + 3) + r]$  ✓  
 $r = 1 \Omega$  ✓  $r = 1 \Omega$  ✓ (4)

8.2.3  $W = I^2 R \Delta t$  ✓  
 $W = (1,5)^2 (3)(180)$  ✓  
 $W = 1\,215 \text{ J}$  ✓ (3)

8.3.1 Decrease/*iyehla.* ✓ (1)

8.3.2 Increase/*iyenyuka.* ✓ (1)

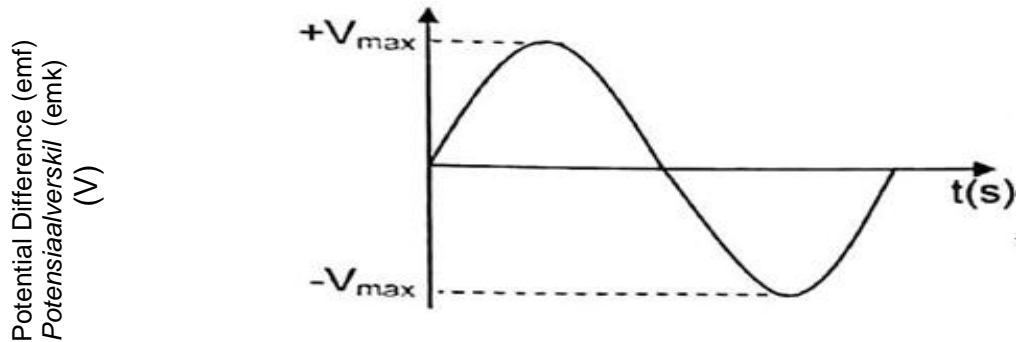
- 8.4 Increase/iyenyuka. ✓  
 $R_{\text{ext}}$  decreases. Current through battery increases. ✓  
 $W = I^2 r \Delta t$  / Energy transfer to the battery/work done by battery increases. ✓ (3)  
**[20]**

### QUESTION/UMBUZO 9

- 9.1 Mechanical energy to electrical energy. ✓✓ (2)

- 9.2 AC generator has slip rings and DC generator has a split ring / commutator ✓ (1)

9.3



CRITERIA FOR MARKING	
Correct shape	✓
Axes labelled correct	✓
$V_{\text{max}}$ indicated on graph	✓

(2)

- 9.4  $P_{\text{ave}} = V_{\text{rms}} I_{\text{rms}}$  ✓  
 $2000 = I_{\text{rms}} \times 230$  ✓  
 $I_{\text{rms}} = 8,70 \text{ A}$   
 $I_{\text{rms}} = \frac{I_{\text{max}}}{\sqrt{2}}$   
 $8,70 = \frac{I_{\text{max}}}{\sqrt{2}}$  ✓  
 $I_{\text{max}} = 12,30 \text{ A}$  ✓
- $P_{\text{gem}} = V_{\text{wgk}} I_{\text{wgk}}$  ✓  
 $2000 = I_{\text{wgk}} \times 230$  ✓  
 $\therefore I_{\text{wgk}} = 8,70 \text{ A}$   
 $I_{\text{wgk}} = \frac{I_{\text{max}}}{\sqrt{2}}$   
 $8,70 = \frac{I_{\text{max}}}{\sqrt{2}}$  ✓  
 $\therefore I_{\text{maks}} = 12,30 \text{ A}$  ✓ (4)

- 9.5  $V_{\text{rms}} = \frac{V_{\text{max}}}{\sqrt{2}}$  ✓  
 $230 = \frac{V_{\text{max}}}{\sqrt{2}}$  ✓  
 $V_{\text{max}}/V_{\text{maks}} = 325,27 \text{ V}$  ✓ (3)  
**[12]**



**QUESTION/UMBUZO 10**

10.1 Work function (of the metal)) ✓

$$E_{k(max)} = \frac{hc}{\lambda} - W_0 \checkmark$$

The intercept on the vertical axis =  $W_0$ .

**OR**

$$\frac{hc}{\lambda} = W_0 + E_{k(max)} \checkmark$$

The intercept on the vertical axis is equal to the  $W_0$ . (3)

10.2  $E = W_0 + E_{k(max)}$   
 $hf = W_0 + E_{k(max)}$  } Any one/nayiphi ✓  
 $hf = hf_0 + E_{k(max)}$

$$\frac{6,63 \times 10^{-34} \times 6,16 \times 10^{14} \checkmark}{f_0} = \frac{6,63 \times 10^{-34} f_0 \checkmark + 5,6 \times 10^{-20} \checkmark}{f_0 = 5,32 \times 10^{14} \text{ Hz } \checkmark} \quad (5)$$

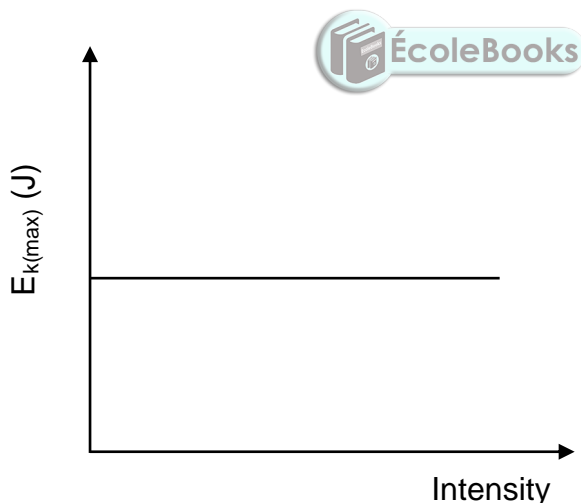
10.3.1 Remain the same/ayitshintshi ✓

The gradient is equal to the product of Planck's constant and the speed of light in vacuum which are constants. ✓

**OR**

Gradient =  $hc$ , which are constants (2)

10.3.2 Remains the same/Ayitshintshi ✓



CRITERIA FOR MARKING	
Axes labelled	✓
Correct shape	✓

(3)  
[13]

**TOTAL/EWONKE: 150**