



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

JUNE 2017

PHYSICAL SCIENCES P1

MARKS: 150

TIME: 3 hours



This question paper consists of 12 pages, including a 2 page data sheet.

INSTRUCTIONS AND INFORMATION

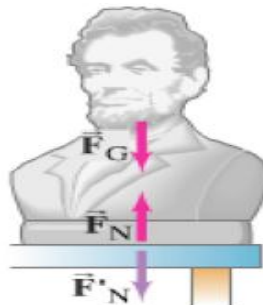
1. Write your NAME and SURNAME in the appropriate space on the ANSWER BOOK.
2. Answer ALL the questions.
3. Non-programmable calculators may be used.
4. Appropriate mathematical instruments may be used.
5. Number the questions correctly according to the numbering system used in this question paper.
6. You are advised to use the attached DATA SHEETS.
7. The formulae and substitutions must be shown in ALL calculations.
8. Give brief motivations, discussions, etc. where required.
9. Round off your final numerical answers to a minimum of TWO decimal places.
10. Start EACH question on a NEW page.
11. All diagrams are not necessarily drawn according to scale.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four possible options are provided as answers to the following questions. Each question has only ONE correct answer. Choose the best answer and write down **A, B, C** or **D** next to the question number (1.1 to 1.10) on your ANSWER BOOK.

- 1.1 When an object falls freely near the earth's surface, its acceleration is always ...
- A. increasing in a downward direction.
 B. decreasing in a downward direction.
 C. $9,8 \text{ m}\cdot\text{s}^{-2}$ in an upward direction.
 D. $9,8 \text{ m}\cdot\text{s}^{-2}$ in a downward direction. (2)
- 1.2 When two cars collide head-on, the collision is inelastic if ...
- A. the change in momentum is zero.
 B. the sum of their initial kinetic energies is not equal to sum of their final kinetic energies.
 C. the sum of their initial kinetic energies is equal to sum of their final kinetic energies.
 D. total linear momenta before collision is not equal total linear momenta after collision. (2)
- 1.3 A school bus suddenly comes to a stop, and all the backpacks on the floor start to slide forward. The backpacks slide forward because ...
- A. the backpacks resist a change in their state of motion.
 B. there is a pushing force applied by the floor on the backpacks.
 C. the backpacks experience a pulling force in a forward direction.
 D. the weight of the backpacks decreased as the bus was stopping. (2)

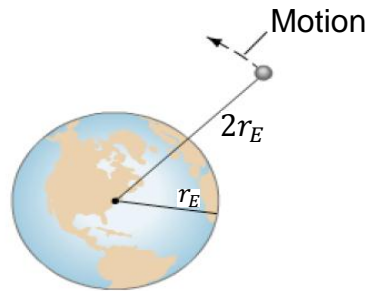
1.4



The diagram above shows a statue resting on a table. F_G is the force of gravity on the statue, F_N is the force of the table on the statue and F'_N is the force of the statue on the table. The action-reaction pair demonstrated in the above diagram is:

- A. $(F_G + F'_N)$ and F_N
 B. F'_N and F_N
 C. F_G and F'_N
 D. F_G and F_N (2)

- 1.5 The diagram below shows a spacecraft orbiting above the earth.

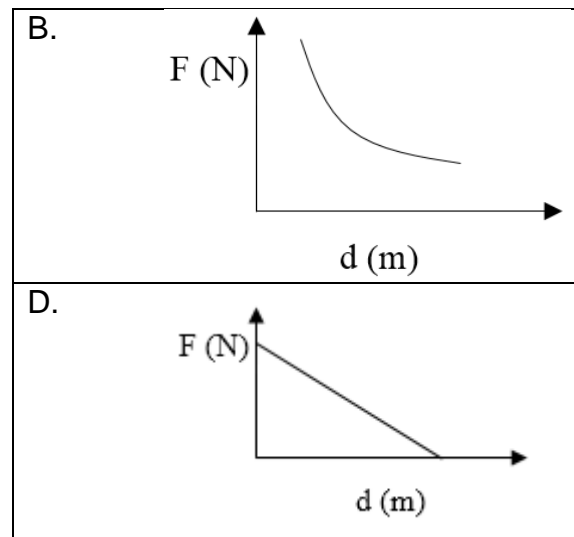
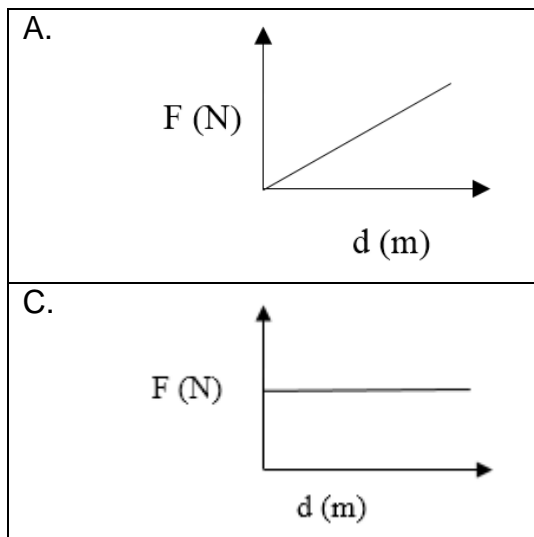


The force gravity on the spacecraft on earth is F_E . What is the force of gravity on the spacecraft when it orbits two earths' radii from the earth's center?

- A. $\frac{1}{4} F_E$
- B. $4 F_E$
- C. $\frac{1}{2} F_E$
- D. $2F_E$ (2)
- 1.6 When a police car with a siren approaches you, it emits sound waves. The sound waves that reach you have a ... wavelength and a ... frequency.

- | | | |
|----|---------|--------|
| A. | shorter | higher |
| B. | longer | higher |
| C. | shorter | lower |
| D. | longer | lower |
- (2)

- 1.7 A test charge placed in an electric field around a negative point experiences an electrostatic force of attraction (F). Which of the following graphs best represents the relationship between the force (F) and the distance (d) between the test charge and the point charge?



- 1.8 An observer on the earth that observes an approaching light source. He will notice that the light from the object will have a shorter wavelength because the distance between the wavefronts (λ) ...
- A. increases as the source moves towards the observer.
 - B. decreases as the source moves towards the observer.
 - C. decreases as the source catches up with its emitted waves.
 - D. increases as the source moves away from its emitted waves. (2)
- 1.9 A force for which the net work done in moving an object between two points is dependant of the path taken is called ...
- A. a non-conservative force.
 - B. an electrostatic force between the surface and the object.
 - C. a conservative force.
 - D. a pulling force. (2)
- 1.10 Two identical balls, M and N, are both thrown from a cliff. Ball M is thrown directly upwards and N is thrown directly downwards. Both balls will hit the bottom of the cliff. If both balls were given the same initial speed, which ball will hit the bottom of the cliff with a greater velocity?
- A. Both balls will have the same velocity at the bottom of the cliff
 - B. Ball M
 - C. Ball N
 - D. Ball M will reach the bottom first (2)

[20]**QUESTION 2**

- 2.1 A person throws a ball upward into the air with an initial velocity of $15 \text{ m}\cdot\text{s}^{-1}$. Ignore the effects of air resistance.
- 2.1.1 What is the physics name given to any object, like the ball above, where ONLY the gravitational force of the earth is acting on it? (1)
- 2.1.2 Calculate how high it goes up before coming down. (4)
- 2.1.3 Calculate how long the ball is in the air before it comes back to the hand. (3)
- 2.1.4 Calculate the time it takes the ball to pass a point of 8 m above the person's hand. (5)
- 2.1.5 Draw position vs. time graph indicating the following times: at point of projection, at 8 m above the hand, at maximum height, back at the thrower's hand. (4)
- 2.2 A stone is dropped from the roof of a building. A second stone was thrown, from the same height, straight down 2 s after the first stone had been dropped with an initial velocity of $30 \text{ m}\cdot\text{s}^{-1}$. After having covered the same displacement, the two stones reach the ground at the same time.
- How long did it take the second stone to reach the ground? (6)

[23]

QUESTION 3

3.1 A golf ball of mass $0,045 \text{ kg}$ is hit off the tee at a speed of $45 \text{ m}\cdot\text{s}^{-1}$. The golf club was in contact with the ball for $3,5 \times 10^{-3} \text{ s}$.

3.1.1 Define the term *impulse*. (2)

3.1.2 Calculate the impulse imparted to the golf ball. (3)

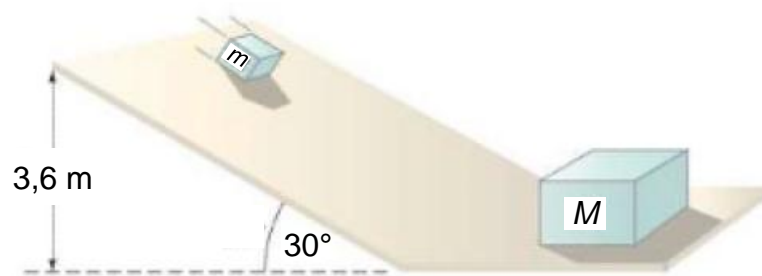
3.1.3 Calculate the average force exerted on the ball by the golf club. (2)

3.2 A tennis ball of mass 60 g strikes the wall perpendicularly at a velocity of $12 \text{ m}\cdot\text{s}^{-1}$. It rebounds at a velocity of $10 \text{ m}\cdot\text{s}^{-1}$.

3.2.1 Calculate the change in momentum of the tennis ball. (5)

3.2.2 What is the magnitude of impulse of the wall on the ball? (1)

3.3 A block of mass $m = 2,20 \text{ kg}$ slides down slides down a 30° incline which is $3,6 \text{ m}$ high. At the bottom, it strikes a stationary block of mass $M = 7,00 \text{ kg}$ resting on a horizontal surface.



Assume that all surfaces are frictionless.

3.3.1 Define the *Principle of Conservation of Linear Momentum* in words. (2)

3.3.2 The block of mass m stops immediately after collision. Calculate the magnitude of the velocity of the block of mass M just after collision. (6)

[21]

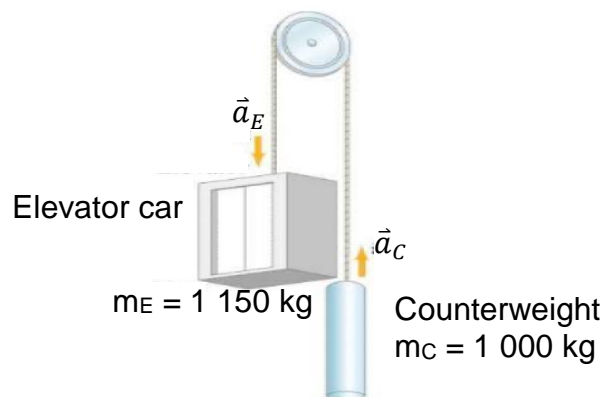
QUESTION 4

- 4.1 A skier in the diagram below, initially at rest, has just begun descending a 30° slope.



Assuming that the coefficient of kinetic friction (μ_k) is 0,10.

- 4.1.1 Draw a free-body diagram of all the forces acting on the skier. (3)
- 4.1.2 Calculate her acceleration down the slope (5)
- 4.1.3 Calculate the magnitude of the velocity she will reach after 4,0 s. (3)
- 4.2 A system of two objects, an elevator and a counterweight, suspended by a pulley and light cable is shown in the diagram below.



The mass of the elevator with four people inside is $m_E = 1\,150$ kg and its mass is 850 kg when empty. The mass of the counterweight is $m_C = 1\,000$ kg.

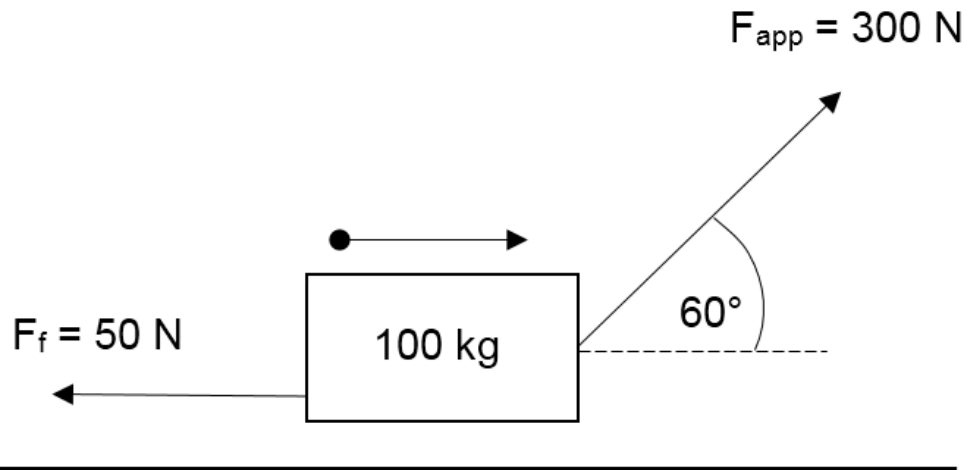
Ignore the mass of the pulley and the mass of the cable.

- 4.2.1 Define *Newton's Second Law of motion* in words. (2)
- 4.2.2 Calculate the acceleration of the elevator. (6)
- 4.2.3 Calculate the tension in the cable. (3)

[22]

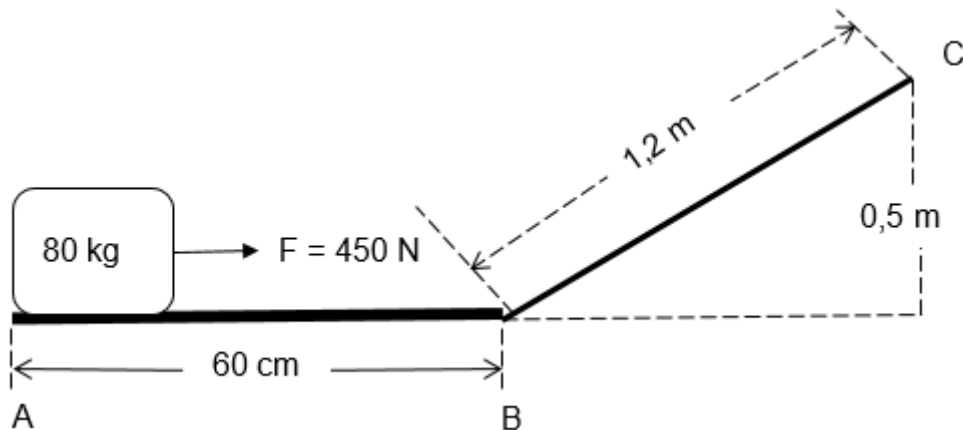
QUESTION 5

- 5.1 A car is travelling along a straight horizontal road. A force of 600 N is applied to the car in the direction that it is travelling, speeding it up. While it is speeding up it covers a distance of 30 m. Calculate the work done on the car. (3)
- 5.2 A box of mass 100 kg was resting on a flat horizontal surface when a force of 300 N was applied to pull at acting at angle of 60° to the horizontal. The box moved a displacement of 6 m to the east while experiencing a frictional force of 50 N.



- 5.2.1 Calculate the amount of work done by the frictional force on the box. (3)
- 5.2.2 Calculate the net work done on the box. (4)
- 5.3 The driver of a 800 kg car travelling at a speed of $20,5 \text{ m}\cdot\text{s}^{-1}$ applies the car's brakes when a red light is observed. The car's brakes provide a frictional force of 6 000 N.
- 5.3.1 Define the *work-energy theorem* in words. (2)
- 5.3.2 Determine the stopping distance of the car. (5)

- 5.4 The diagram below shows a box that was stationary, being pushed with a constant force of 450 N across a frictionless horizontal surface which is 60 cm long.



The box then moves up an incline due to the same force of 450 N. The coefficient of kinetic friction between the box and the inclined surface is 0,34.

- 5.4.1 Calculate the net work done on the object as it moves from point A and reaches point B with a velocity of $25 \text{ m}\cdot\text{s}^{-1}$. (3)
- 5.4.2 What is magnitude of the kinetic friction experienced by the box as moves from point B to point C? (4)
- 5.4.3 Draw a free body diagram of all forces acting on the box when it is at point C. (4)
- 5.4.4 Calculate the net work done on the box as it reaches point C. (4)
- 5.4.5 What would be the gravitational potential energy of the box at C? (3)

[35]

QUESTION 6

- 6.1 The siren of a moving ambulance emits waves at a frequency of 350 Hz. The frequency of the sound as heard by the listener standing along the road is 400 Hz.

6.1.1 Define the *Doppler Effect*. (2)

6.1.2 Was the ambulance moving towards or away from the listener? Explain your answer, making special reference to *frequency*, *wavefronts* and *wavelength*. (4)

6.1.3 If the speed of sound in the air is $340 \text{ m}\cdot\text{s}^{-1}$, determine the velocity at which the ambulance was moving. (4)

- 6.2 A police car travelling down a road at constant speed emits sound waves from its siren. A lady stands on the side of the road with a detector which registers sound waves at a frequency of 450 Hz as the police car approaches her. After passing her, and moving away at the same constant speed, sound waves of frequency 390 Hz are registered. Assume that the speed of sound in air is $343 \text{ m}\cdot\text{s}^{-1}$.

Calculate:

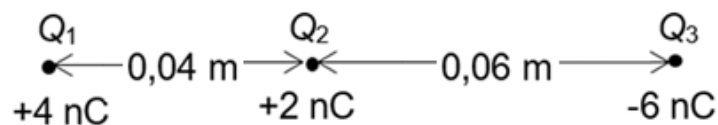
6.2.1 The speed at which the ambulance is moving. (7)

6.2.2 The frequency at which the siren emits the sound waves. (3)

[20]

QUESTION 7

- 7.1 Three point charges are in a straight line. Their charges are $Q_1 = +4 \times 10^{-9} \text{ C}$, $Q_2 = +2 \times 10^{-9} \text{ C}$ and $Q_3 = -6 \times 10^{-9} \text{ C}$. The distance between Q_1 and Q_2 is $2 \times 10^{-2} \text{ m}$ and the distance between Q_2 and Q_3 is $4 \times 10^{-2} \text{ m}$.



7.1.1 Define *Coulomb's Law* in words (2)

7.1.2 What is the net electrostatic force on Q_2 due to the other two charges? (7)

[9]

TOTAL: 150

**DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 1 (PHYSICS)**

**GEGEWENS VIR FISIESTE WETENSKAPPE GRAAD 12
VRAESTEL 1 (FISIKA)**

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIESTE KONSTANTES

| NAME/NAAM | SYMBOL/SIMBOOL | VALUE/WAARDE |
|--|----------------|---|
| Acceleration due to gravity <i>Swaartekragversnelling</i> | g | 9,8 m·s ⁻² |
| Universal gravitational constant <i>Universele gravitasiekonstant</i> | G | 6,67 × 10 ⁻¹¹ N·m ² ·kg ⁻² |
| Speed of light in a vacuum <i>Spoed van lig in 'n vakuum</i> | c | 3,0 × 10 ⁸ m·s ⁻¹ |
| Planck's constant <i>Planck se konstante</i> | h | 6,63 × 10 ⁻³⁴ J·s |
| Coulomb's constant <i>Coulomb se konstante</i> | k | 9,0 × 10 ⁹ N·m ² ·C ⁻² |
| Charge on electron <i>Lading op elektron</i> | -e | -1,6 × 10 ⁻¹⁹ C |
| Electron mass <i>Elektronmassa</i> | m _e | 9,11 × 10 ⁻³¹ kg |
| Mass of Earth <i>Massa van Aarde</i> | M | 5,98 × 10 ²⁴ kg |
| Radius of Earth <i>Radius van Aarde</i> | R _E | 6,38 × 10 ⁶ m |

TABLE 2: FORMULAE/TABEL 2: FORMULES

MOTION/BEWEGING

| | |
|---|---|
| $v_f = v_i + a \Delta t$ | $\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$ or/of $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ |
| $v_f^2 = v_i^2 + 2a\Delta x$ or/of $v_f^2 = v_i^2 + 2a\Delta y$ | $\Delta x = \left(\frac{v_i + v_f}{2} \right) \Delta t$ or/of $\Delta y = \left(\frac{v_i + v_f}{2} \right) \Delta t$ |

FORCE / KRAG

| | |
|--|---|
| $F_{\text{net}} = ma$ | $p = mv$ |
| $f_s^{\text{max}} = \mu_s N$ | $f_k = \mu_k N$ |
| $F_{\text{net}} \Delta t = \Delta p$ $\Delta p = mv_f - mv_i$ | $w = mg$ |
| $F = G \frac{m_1 m_2}{d^2}$ or/of $F = G \frac{m_1 m_2}{r^2}$ | $g = G \frac{M}{d^2}$ or/of $g = G \frac{M}{r^2}$ |

WORK, ENERGY AND POWER/ARBEID, ENERGIE EN DRYWING

| | |
|--|---|
| $F_{\text{net}} = ma$ | $p = mv$ |
| $f_s^{\text{max}} = \mu_s N$ | $f_k = \mu_k N$ |
| $F_{\text{net}} \Delta t = \Delta p$ $\Delta p = mv_f - mv_i$ | $w = mg$ |
| $F = G \frac{m_1 m_2}{d^2}$ or/of $F = G \frac{m_1 m_2}{r^2}$ | $g = G \frac{M}{d^2}$ or/of $g = G \frac{M}{r^2}$ |

WAVES, SOUND AND LIGHT/GOLWE, KLANK EN LIG

| | |
|--|---|
| $v = f \lambda$ | $T = \frac{1}{f}$ |
| $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ $f_L = \frac{v \pm v_L}{v \pm v_b} f_b$ | $E = hf$ or /of $E = h \frac{c}{\lambda}$ |
| $E = W_o + E_{k(\text{max})}$ or/of $E = W_o + K_{\text{max}}$ where/waar | |
| $E = hf$ and/en $W_o = hf_o$ and/en $E_{k(\text{max})} = \frac{1}{2} mv_{\text{max}}^2$ or/of $K_{\text{max}} = \frac{1}{2} mv_{\text{max}}^2$ | |

ELECTROSTATICS / ELEKTROSTATIKA

| | |
|---|----------------------|
| $F = \frac{kQ_1 Q_2}{r^2}$ | $E = \frac{kQ}{r^2}$ |
| $V = \frac{W}{q}$ | $E = \frac{F}{q}$ |
| $n = \frac{Q}{e}$ or/of $n = \frac{Q}{q_e}$ | |



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL/NASIONALE
SENIOR
CERTIFICATE/SERTIFIKAAT**

GRADE/GRAAD 12

JUNE/JUNIE 2017

**PHYSICAL SCIENCES P1/
FISIESE WETENSKAPPE V1
MEMORANDUM**

MARKS/PUNT: 150

This memorandum consists of 16 pages./
Hierdie memorandum bestaan uit 16 bladsye.

GENERAL GUIDELINES/ALGEMENE RIGLYNE**1. CALCULATIONS/BEREKENINGE**

- 1.1 **Marks will be awarded for:** correct formula, correct substitution, correct answer with unit.
Punte sal toegeken word vir: korrekte formule, korrekte substitusie, korrekte antwoord met eenheid.
- 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.
Geen punte sal toegeken word waar 'n verkeerde of ontoepaslike formule gebruik word nie, selfs al is daar relevante simbole en relevante substitusies.
- 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.
Wanneer 'n fout gedurende substitusie in 'n korrekte formule begaan word, sal 'n punt vir die korrekte formule en vir korrekte substitusies toegeken word, maar geen verdere punte sal toegeken word nie.
- 1.4 If **no formula** is given, but **all substitutions are correct**, a candidate will **forfeit one mark**.
Indien geen formule gegee is nie, maar al die substitusies is korrek, verloor die kandidaat een punt.
- 1.5 **No penalisation** if **zero substitutions are omitted** in calculations where **correct formula/principle** is correctly given.
Geen penalisering indien nulwaardes nie getoon word nie in berekeninge waar die formule/beginsel korrek gegee is nie.
- 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.
Wiskundige manipulasies en verandering van die onderwerp van toepaslike formules tel geen punte nie, maar indien 'n kandidaat met die korrekte formule begin en dan die onderwerp van die formule verkeerde verander, sal die punte vir die formule en korrekte substitusies toegeken word. Die punt vir die verkeerde numeriese antwoord word verbeur.
- 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.
Punte word slegs vir 'n formule toegeken indien 'n poging tot 'n berekening aangewend is, d.w.s. substitusies is gedoen of 'n numeriese antwoord is gegee.
- 1.8 Marks can only be allocated for substitutions when values are substituted into formulae and not when listed before a calculation starts.
Punte kan slegs toegeken word vir substitusies wanneer waardes in formules ingestel word en nie vir waardes wat voor 'n berekening gelys is nie.

- 1.9 All calculations, when not specified in the question, must be done to a minimum of two decimal places.
Alle berekenings, wanneer nie in die vraag gespesifiseer word nie, moet tot 'n minimum van twee desimale plekke gedoen word.
- 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.
Indien 'n finale antwoord van 'n berekening korrek is, sal volpunte nie outomaties toegeken word nie. Nasieners sal altyd verseker dat die korrekte/toepaslike formule gebruik word en dat bewerkings, insluitende substitusies korrek is.
- 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 no count any marks.
Vrae waar 'n reeks berekeninge gedoen moet word (bv. 'n stroombaan-diagramvraag) hoef nie noodwendig dieselfde volgorde te hê nie. VOLPUNTE sal toegeken word op voorwaarde dat dit 'n geldige oplossing vir die probleem is. Enige berekening wat egter nie die kandidaat nader aan die antwoord as die oorspronklike data bring nie, sal geen punte tel nie.

2. UNITS/EENHEDE

- 2.1 Candidates will only be penalised once for the repeated use of an incorrect unit **within a question**.
Kandidate sal slegs een keer gepenaliseer word vir die herhaaldelike gebruik van 'n verkeerde eenheid in 'n vraag.
- 2.2 Units are only required in the final answer to a calculation.
Eenhede word slegs in die finale antwoord op 'n vraag verlang.
- 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
- Punte sal slegs vir 'n antwoord en nie vir 'n eenheid per se toegeken word nie. Kandidate sal die punt vir die antwoord in die volgende gevalle verbeur:*
- *Korrekte antwoord + verkeerde eenheid*
 - *Verkeerde antwoord + korrekte eenheid*
 - *Korrekte antwoord + geen eenheid*
- 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 eenhede moet gebruik word, behalwe in sekere gevalle, bv. $V \cdot m^{-1}$ in plaas van $N \cdot C^{-1}$, en $cm \cdot s^{-1}$ of $km \cdot h^{-1}$ in plaas van $m \cdot s^{-1}$ waar die vraag dit regverdig.

3. GENERAL/ALGEMEEN

- 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.
Indien een antwoord of berekening verlang word, maar twee word deur die kandidaat gegee, sal slegs die eerste een nagesien word, ongeag watter een korrek is. Indien twee antwoorde verlang word, sal slegs die eerste twee nagesien word, ens.
- 3.2 For marking purposes, alternative symbols (s, u, t etc.) will also be accepted.
Vir nasiendoeleindes sal alternatiewe simbole (s, u, t ens.) ook aanvaar word.
- 3.3 Separate compound units with a multiplication dot, no a full stop, for example, $m \cdot s^{-1}$.
For marking purposes, $m \cdot s^{-1}$ and m/s will also be accepted.
Skei saamgestelde eenhede met 'n vermenigvuldigingspunt en nie met 'n punt nie, byvoorbeeld $m \cdot s^{-1}$. Vir nasiendoeleindes sal $m \cdot s^{-1}$ en m/s ook aanvaar word.

4. POSITIVE MARKING/POSITIEWE NASIEN

Positive marking regarding calculations will be followed in the following cases:

Positiewe nasien met betrekking tot berekeninge sal in die volgende gevalle geld:

- 4.1 **Subquestion to subquestion:** When a certain variable is calculated in one subquestion (e.g. 3.1) and needs to be substituted in another (3.2 or 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 subquestions.
Subvraag na subvraag: *Wanneer 'n sekere veranderlike in een subvraag (bv. 3.1) bereken word en dan in 'n ander vervang moet word (3.2 of 3.3), bv. indien die antwoord vir 3.1 verkeerd is en word korrek in 3.2 of 3.3 vervang, word **volpunte** vir die daaropvolgende subvraag toegeken.*
- 4.2 **A multistep question in a subquestion:** 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.
'n Vraag met veelvuldige stappe in 'n subvraag: *Indien 'n kandidaat bv. die stroom verkeerd bereken in 'n eerste stap as gevolg van 'n substitusiefout, verloor die kandidaat die punt vir die substitusie sowel as die finale antwoord.*

5. NEGATIVE MARKING/NEGATIEWE NASIEN

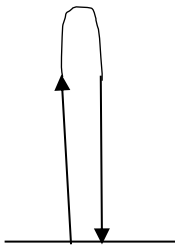

Normally an incorrect answer cannot be correctly motivated if based on a conceptual mistake. If the candidate is therefore required to motivate in QUESTION 3.2 the answer given in QUESTION 3.1, and 3.1 is incorrect, no marks can be awarded for QUESTION 3.2. However, if the answer for e.g. 3.1 is based on a calculation, the motivation for the incorrect answer could be considered.
'n Verkeerde antwoord, indien dit op 'n konsepsuele fout gebaseer is, kan normaalweg nie korrek gemotiveer word nie. Indien 'n kandidaat gevra word om in VRAAG 3.2 die antwoord op VRAAG 3.1 te motiveer en 3.1 is verkeerd, kan geen punte vir VRAAG 3.2 toegeken word nie. Indien die antwoord op bv. 3.1 egter op 'n berekening gebaseer is, kan die motivering vir die verkeerde antwoord in 3.2 oorweeg word.

QUESTION/VRAAG 1

| | | |
|------|------|-----|
| 1.1 | D ✓✓ | (2) |
| 1.2 | B ✓✓ | (2) |
| 1.3 | A ✓✓ | (2) |
| 1.4 | B ✓✓ | (2) |
| 1.5 | A ✓✓ | (2) |
| 1.6 | A ✓✓ | (2) |
| 1.7 | B ✓✓ | (2) |
| 1.8 | C ✓✓ | (2) |
| 1.9 | A ✓✓ | (2) |
| 1.10 | A ✓✓ | (2) |

[20]

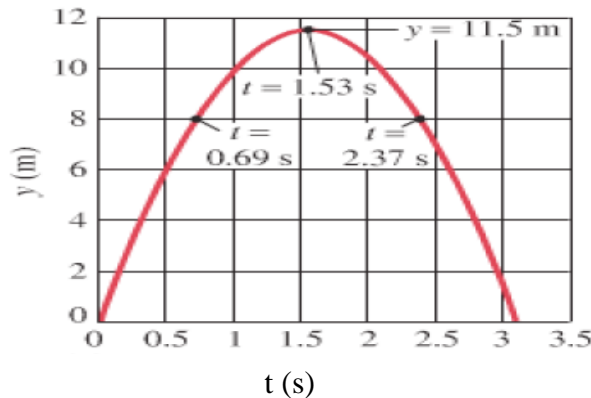
QUESTION/VRAAG 2

| | | | |
|-------|--|---|-----|
| 2.1 |   | | |
| 2.1.1 | It is called a projectile /Dit word 'n projektiel genoem ✓ | | (1) |
| 2.1.2 | <p>OPTION/OPSIE 1</p> <p>Data: $v_i = 15 \text{ m}\cdot\text{s}^{-1}$, $g = -9,8 \text{ m}\cdot\text{s}^{-2}$ $h_{\text{max}} = ?$ $v_f = 0 \text{ m}\cdot\text{s}^{-1}$ at max height <i>(by maks hoogte)</i> (Let downward be negative) (Laat afwaarts negatief wees) $v_f^2 = v_i^2 + 2g\Delta y$ ✓ $0^2 = (15)^2 + 2(-9,8)(\Delta y)$ ✓ $19,6\Delta y = 225$ $\therefore \Delta y = h_{\text{max}} = 11,48 \text{ m}$ ✓</p> | <p>OPTION/OPSIE 2</p> <p>[for upward motion] <i>[vir opwaartse beweging]</i> $v_f = v_i + g \Delta t$ $0 = 15 + (-9,8) \Delta t$ ✓ $\Delta t = \frac{15}{9,8} = 1,53\text{s}$ $\Delta y = v_i \Delta t + \frac{1}{2} g \Delta t^2$ ✓ $= (15)(1,53) + \frac{1}{2} (-9,8)(1,53)^2$ ✓ $\therefore \Delta y = h_{\text{max}} = 11,48 \text{ m}$ ✓</p> | |
| | <p>OPTION/OPSIE 3</p> <p>$v_f = v_i + g \Delta t$ $0 = 15 + (-9,8) \Delta t$ ✓ $\Delta t = \frac{15}{9,8}$ $= 1,53\text{s}$ $\Delta y = \frac{v_f + v_i}{2} \Delta t$ ✓ $= \frac{0 + 15}{2} \times 1,53$ ✓ $\therefore \Delta y = h_{\text{max}} = 11,48 \text{ m}$ ✓</p> | | (4) |

| | | | |
|-------|--|--|-----|
| 2.1.3 | <p><u>OPTION/OPSIE 1</u> $\Delta t = ?$ $\Delta y = v_i \Delta t + \frac{1}{2} g \Delta t^2 \checkmark$ $0 = 15 \Delta t + \frac{1}{2} (-9,8) \Delta t^2 \checkmark$ $-9,8 \Delta t^2 + 30 \Delta t = 0$ $-\Delta t(9,8 \Delta t - 30) = 0$ $\Delta t = \frac{30}{9,8}$ $\therefore \Delta t = 3,06s \checkmark$</p> | <p><u>OPTION/OPSIE 2</u> $v_f = v_i + g \Delta t \checkmark$ [for upward motion] [<i>vir opwaartse beweging</i>] $0 = 15 + (-9,8) \Delta t \checkmark$ $\Delta t = \frac{15}{9,8} = 1,53s$ \therefore total time / <i>totale tyd</i> = $2(1,53)$ = $3,06s \checkmark$</p> | (3) |
| 2.1.4 | <p>$\Delta y = 8 \text{ m}$ $\Delta t = ?$ $\Delta y = v_i \Delta t + \frac{1}{2} g \Delta t^2 \checkmark$ $8 \checkmark = 15 \Delta t + \frac{1}{2} (-9,8) \Delta t^2 \checkmark$ $4,9 \Delta t^2 - 15 \Delta t + 8 = 0$ Using a quadratic formula to find the roots: <i>Gebruik 'n kwadratiese formule of die wortels te bereken:</i> $\Delta t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-15) \pm \sqrt{(-15)^2 - 4(4,9)(8)}}{2(4,9)}$ $= \frac{15 \pm \sqrt{225 - 156,8}}{9,8}$ $= \frac{15 \pm 8,26}{9,8}$ $\therefore \Delta t = 2,37s \checkmark$ or $\Delta t = 0,69s \checkmark$ Both values of Δt are acceptable/<i>Albei waardes vir Δt aanvaarbaar</i></p> | (5) | |

2.1.5

Position vs time graph / *Posisie vs tyd grafiek*



| | |
|---|----|
| Both axes labelled / <i>Albei asse met byskrifte</i> | ✓ |
| All points plotted as directed / <i>Alle punte geplot soos gevra</i> | ✓✓ |
| Correct shape | ✓ |
| NOTE: Take away a mark if not all points are plotted : For the maximum height accept y value = 11.48 m or 11.5 m on the graph AANDAG: <i>Neem 1 punt weg indien nie alle punte geplot nie.</i> : <i>Vir die maksimum hoogte, aanvaar y = 11,48 of 11,5 m op die grafiek.</i> | |

(4)

2.2

OPTION/OPSIE 1

(Take downwards as positive)
(*Afwaarts positief*)

Stone/Klip 1:

$$\Delta y_1 = v_i \Delta t + \frac{1}{2} g \Delta t^2 \quad \text{For both } \checkmark$$

$$= 0 \times \Delta t + \frac{1}{2} (9,8) \Delta t^2 \quad \checkmark$$

$$\Delta y_1 = 4,9 \Delta t^2 \quad \{\text{For } \Delta t = t\}$$

$$\therefore \Delta y_1 = 4,9 t^2$$

Stone/Klip 2:

$$\Delta y_2 = v_i \Delta t + \frac{1}{2} g \Delta t^2$$

$$= 30 \Delta t + \frac{1}{2} (9,8) \Delta t^2 \quad \checkmark \quad \{\Delta t = t - 2\}$$

$$\therefore \Delta y_2 = 30(t - 2) + 4,9(t - 2)^2$$

But / *maar* $\Delta y_1 = \Delta y_2$, \therefore

$$4,9 t^2 = 30(t - 2) + 4,9(t - 2)^2 \quad \checkmark$$

$$10,4t = 40,4$$

$$\therefore t = 3,89s$$

For second stone / *Vir tweede klip*

$$t - 2 = 3,89 - 2 \quad \checkmark$$

$$= 1,89s \quad \checkmark$$

OPTION/OPSIE 2

(Take downwards as positive)
(*Afwaarts positief*)

Stone/Klip 1:

$$\Delta y_1 = v_i \Delta t + \frac{1}{2} g \Delta t^2 \quad \checkmark$$

$$= 0 \times \Delta t + \frac{1}{2} (9,8) \Delta t^2 \quad \checkmark$$

$$\Delta y_1 = 4,9 \Delta t^2 \quad \{\text{For } \Delta t = t + 2\}$$

$$\therefore \Delta y_1 = 4,9 (t + 2)^2$$

Stone/Klip 2:

$$\Delta y_2 = v_i \Delta t + \frac{1}{2} g \Delta t^2 \quad \text{For both } \checkmark$$

$$= 30 \Delta t + \frac{1}{2} (9,8) \Delta t^2 \quad \checkmark \quad \{\Delta t = t\}$$

$$\therefore \Delta y_2 = 30(t) + 4,9(t)^2$$

But / *maar* $\Delta y_1 = \Delta y_2$, \therefore

$$4,9 (t + 2)^2 = 30(t) + 4,9(t)^2 \quad \checkmark$$

$$10,4t = 19,6$$

$$\therefore t = 1,89s \quad \checkmark \checkmark$$

For second stone / *Vir tweede klip*

$$1,89s$$

(6)

[23]

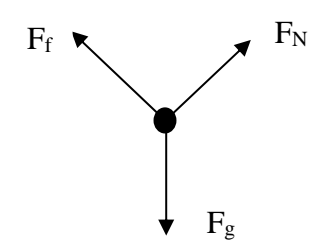
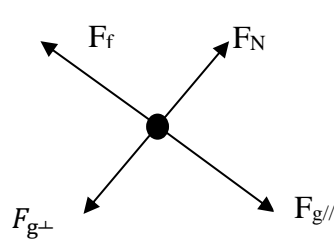
QUESTION/VRAAG 3

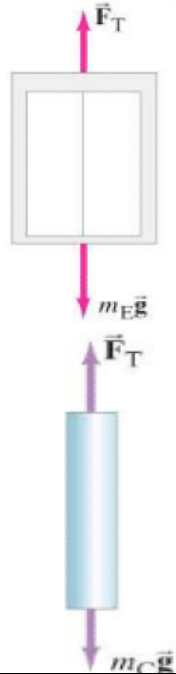
| | | | | |
|-----|-------|---|--|-----|
| 3.1 | 3.1.1 | <p>Impulse is the <u>product of the net force acting</u> ✓ on an object and the <u>time the net force acts on the object</u> ✓ .</p> <p>OR</p> <p>It is a <u>measure of how hard</u> ✓ and <u>for how long does a net force act</u> ✓ on an object</p> <p><i>Impuls is die produk van die netto krag</i> ✓ <i>wat op 'n voorwerp inwerk en die tyd wat die netto krag op die voorwerp inwerk.</i> ✓</p> <p>OF</p> <p>Dit is die <u>maatstaf vir hoe hard</u> ✓ <u>en vir hoe lank 'n netto krag op 'n voorwerp inwerk.</u> ✓</p> | (2) | |
| | 3.1.2 | <p>OPTION/OPSIE 1</p> $F_{\text{net}} \Delta t = m \Delta v \checkmark$ $= 0,045(45 - 0) \checkmark$ $= 2,03 \text{ N}\cdot\text{s} \checkmark$ | <p>OPTION/OPSIE 2</p> <p>Impulse = Change in momentum</p> <p><i>Impuls = verandering in momentum</i></p> $\Delta p = m\Delta v \checkmark$ $= 0,045(45 - 0) \checkmark$ $= 2,03 \text{ kg}\cdot\text{s}^{-1}$ <p>Impulse / <i>Impuls</i> = 2,03 N·s ✓</p> | (3) |
| | 3.1.3 | $F_{\text{net}} = \frac{m \Delta v}{\Delta t}$ $= \frac{2,03}{3,5 \times 10^{-3}} \checkmark$ $= 580 \text{ N} \checkmark$ | (2) | |
| 3.2 | 3.2.1 | <p>Take direction towards the wall as positive/ <i>Neem rigting na die muur as positief</i></p> <p>$m = 60 \text{ g} = 0,060 \text{ kg}$</p> <p>$v_i = 12 \text{ m}\cdot\text{s}^{-1}$</p> <p>$v_f = -10 \text{ m}\cdot\text{s}^{-1}$</p> <p>$\Delta p = ?$</p> <p>$\Delta p = m(v_f - v_i) \checkmark$</p> $= 0,060 \checkmark (-10 - 12) \checkmark$ $= -1,32 \text{ kg}\cdot\text{m}\cdot\text{s}^{-1}$ <p>$\Delta p = 1,32 \text{ kg}\cdot\text{m}\cdot\text{s}^{-1} \checkmark$ away from the wall/<i>weg vanaf die muur</i> ✓</p> | (5) | |
| | 3.2.2 | 1,32 N·s or/of 1,32 kg·m·s ⁻¹ ✓ | (1) | |

| | | | |
|-----|-------|--|-----|
| 3.3 | 3.3.1 | <p>The <u>total linear momentum of an isolated</u> ✓ system <u>remains constant / is conserved.</u> ✓ OR/OF</p> <p>The <u>total linear momentum of an isolated system before collision</u> ✓ is equal to the <u>total linear momentum after collision.</u> ✓</p> <p><i>Die <u>totale lineêre momentum van 'n geslote sisteem</u> ✓ <u>bly konstant / bly behoue</u> ✓</i></p> <p>OF</p> <p><i>Die <u>totale lineêre momentum van 'n geslote sisteem voor 'n botsing</u> ✓ is <u>gelyk aan die totale liniêre momentum na die botsing</u> ✓</i></p> | (2) |
| | 3.3.2 | <p>There is a need to calculate the velocity of block m just before collision/<i>Bereken die snelheid van blok m voor die botsing:</i></p> <p>$E_{m \text{ top/bo}} = E_{m \text{ bottom/onder}}$</p> <p>$(E_P + E_K)_{\text{top/bo}} = (E_P + E_K)_{\text{bottom/onder}} \checkmark$</p> <p>$mgh + 0 = 0 + \frac{1}{2} mv^2$</p> <p>$2gh = v^2$</p> <p>$v = \sqrt{2gh}$</p> <p>$= \sqrt{2(9,8)(3,6)} \checkmark$</p> <p>$= 8,40 \text{ m}\cdot\text{s}^{-1} \checkmark$</p> <p>$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f} \checkmark$</p> <p><u>$2,2 \times 8,4 + 7 \times 0 = 2,2 \times 0 + 7 v_{2f}$</u> ✓</p> <p>$v_{2f} = 2,64 \text{ m}\cdot\text{s}^{-1} \checkmark$</p> | (6) |

[21]

QUESTION/VRAAG 4

| | | | | | | | | | | | | | | | | |
|---|-------|---|-------|-----|-------|---|-------|---|--|---|---|-------|---|-------|---|-----|
| 4.1 | 4.1.1 | <p>OPTION/OPSIE 1</p>  <table border="1" data-bbox="351 526 662 683"> <tr> <td>F_g</td> <td>✓</td> </tr> <tr> <td>F_N</td> <td>✓</td> </tr> <tr> <td>F_f</td> <td>✓</td> </tr> </table> | F_g | ✓ | F_N | ✓ | F_f | ✓ | <p>OPTION/OPSIE 2</p>  <table border="1" data-bbox="710 526 1212 683"> <tr> <td>Both components ($F_{g\parallel}$ and $F_{g\perp}$) <i>Albei komponente ($F_{g\parallel}$ en $F_{g\perp}$)</i></td> <td>✓</td> </tr> <tr> <td>F_N</td> <td>✓</td> </tr> <tr> <td>F_f</td> <td>✓</td> </tr> </table> | Both components ($F_{g\parallel}$ and $F_{g\perp}$) <i>Albei komponente ($F_{g\parallel}$ en $F_{g\perp}$)</i> | ✓ | F_N | ✓ | F_f | ✓ | (3) |
| F_g | ✓ | | | | | | | | | | | | | | | |
| F_N | ✓ | | | | | | | | | | | | | | | |
| F_f | ✓ | | | | | | | | | | | | | | | |
| Both components ($F_{g\parallel}$ and $F_{g\perp}$) <i>Albei komponente ($F_{g\parallel}$ en $F_{g\perp}$)</i> | ✓ | | | | | | | | | | | | | | | |
| F_N | ✓ | | | | | | | | | | | | | | | |
| F_f | ✓ | | | | | | | | | | | | | | | |
| | 4.1.2 | <p>$F_{g\parallel} = mg \sin \theta$ $F_{g\perp} = - mg \cos \theta$ (opposite direction of F_N) <i>(teenoorgestelde rigting as F_N)</i> Applying Newton's Second law for the motion parallel to the slope: <i>Toepassing van Newton se Tweede Wet van die beweging parallel aan die skuinsvlak:</i> $F_{g\parallel} + F_f = ma$ $mg \sin \theta - \mu_k F_N = ma \dots\dots\dots (1)$ } ✓ for one of the two/ <i>vir een van die twee</i> Applying Newton's Second law for the motion perpendicular to the slope/ <i>Toepassing van Newton se Tweede Wet van die beweging loodreg aan die skuinsvlak::</i> $F_N + F_{G\perp} = ma$ $F_N - mg \cos \theta = ma \dots\dots\dots (2)$ (Since there is no motion perpendicular to the slope $a = 0 \text{ m}\cdot\text{s}^{-2}$) <i>(Geen beweging loodreg aan skuinsvlak dus $a = 0 \text{ m}\cdot\text{s}^{-2}$)</i> $\therefore F_N = mg \cos \theta$ ✓ (Substitute/Vervang F_N in (1)) $mg \sin \theta - \mu_k(mg \cos \theta) = ma$ (dividing by m) $g \sin \theta - \mu_k(g \cos \theta) = a$ ✓ (Substitute/Vervang $\mu_k = 0,10$, $g = 9,8 \text{ m}\cdot\text{s}^{-2}$ and/en $\theta = 30^\circ$) $9,8 \sin 30^\circ - 0,10 \times 9,8 \times \cos 30^\circ = a$ ✓ $\therefore a = 4,00 \text{ m}\cdot\text{s}^{-2}$ ✓</p> | | (5) | | | | | | | | | | | | |
| | 4.1.3 | <p>$v_f = v_i + a\Delta t$ ✓ $= 0 + 4 \times 4$ ✓ $= 16 \text{ m}\cdot\text{s}^{-1}$ ✓</p> | | (3) | | | | | | | | | | | | |

| | | | |
|-------|---|--|-----|
| 4.2 | 4.2.1 | <p>When a net force/resultant force acts on an object, it produces the acceleration of the object in the direction of the net force/resultant force. <u>This acceleration is directly proportional to the net/resultant force</u> ✓ and <u>inversely proportional to the mass of the object.</u> ✓</p> <p><i>Indien 'n netto krag op 'n voorwerp inwerk, versnel die voorwerp in die rigting van die netto krag. <u>Die versnelling is direk eweredig aan die netto krag</u> ✓ en <u>omgekeerd eweredig aan die massa van die voorwerp.</u> ✓</i></p> | (2) |
| | 4.2.2 | <p>Take down wards as negative/Afwaarts as negatief For the Elevator/Vir die hysbak</p>  <p> $F_{net} = F_T - m_E g = m_E a_E = - m_E a \quad (a_E = - a)$ $F_T - m_E g = - m_E a \quad \checkmark \quad \text{-----} (1)$ </p> <p>For the counterweight/Vir die teengewig</p> <p> $F_{net} = F_T - m_C g = m_C a_C = m_C a \quad (a_E = a)$ $F_T - m_C g = m_C a \quad \checkmark \quad \text{.....} (2)$ $(2) - (1) : m_E g - m_C g = m_E a + m_C a$ $g(m_E - m_C) = a(m_E + m_C) \quad \checkmark$ $a = \frac{g(m_E - m_C)}{(m_E + m_C)}$ $= \frac{9,8(1150 - 1000) \checkmark}{(1150 + 1000) \checkmark} \quad \text{OR/OF}$ $= 0,68 \text{ m} \cdot \text{s}^{-2} \quad \checkmark$ </p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> $9,8(1150 - 1000) \checkmark = a(1150 + 1000) \checkmark$ $1470 = 2150a$ $a = 0,68 \text{ m} \cdot \text{s}^{-2} \checkmark$ </div> | (6) |
| 4.2.3 | <p><u>OPTION/OPSIE 1</u> <u>For the counterweight</u> $F_T - m_C g = m_C a \quad \checkmark$ $F_T - 1000(9,8) = 1000(0,68) \quad \checkmark$ $F_T = 10\,480 \text{ N} \quad \checkmark$</p> | <p><u>OPTION/OPSIE 2</u> <u>For the Elevator</u> $F_T - m_E g = -m_E a \quad \checkmark$ $F_T - 1150(9,8) = -1150(0,68) \quad \checkmark$ $F_T = 10\,488 \text{ N} \quad \checkmark$</p> | (3) |

[22]

QUESTION/VRAAG 5

| | | |
|-----|--|-----|
| 5.1 | $W = F\Delta x \cos\theta \checkmark$ $= 600 \times 30 \times \cos 0^\circ$ $= 600 \times 30 \times 1 \checkmark$ $= 18\,000 \text{ J} \checkmark$ | (3) |
| 5.2 | 5.2.1 $W_f = F_f \Delta x \cos\theta \checkmark$ $= 50 \times 6 \times \cos 180^\circ$ $= 50 \times 6 \times -1 \checkmark$ $= -300 \text{ J} \checkmark$ | (3) |
| | 5.2.2 OPTION/OPSIE 1 {Positive marking from/ Merk positief vanaf 5.2.1} $W_{\text{net}} = W_f + W_{\text{HC}} \checkmark$ $= F_f \Delta x \cos\theta + F_{\text{app}} \Delta x \cos\phi \checkmark$ $= -300 \checkmark + 300 \times 6 \times \cos 60^\circ \checkmark$ $= -300 + 900$ $= 600 \text{ J} \checkmark$ | (4) |
| | OPTION/OPSIE 2 {Positive marking from/ Merk positief vanaf 5.2.1} $F_{\text{net}} = F_f + F_{\text{app}} \cos 60^\circ$ $= -50 + 300 \times 0,5 \checkmark$ $= 100 \text{ N}$ $W_{\text{net}} = F_{\text{net}} \Delta x \cos\theta \checkmark$ $= 100 \times 6 \times 1 \checkmark$ $= 600 \text{ J} \checkmark$ | |
| 5.3 | 5.3.1 The <u>net work done on an object is equal</u> \checkmark to the <u>change in the kinetic energy of the object.</u> \checkmark OR The <u>amount of work done by a net force</u> \checkmark on object <u>is equal to the change in the object's kinetic energy.</u> \checkmark <u>Die netto arbeid op 'n voorwerp verrig is gelyk</u> \checkmark <u>aan die verandering in kinetiese energie van die voorwerp.</u> \checkmark OF <u>Die hoeveelheid arbeid verrig deur 'n netto krag</u> \checkmark <u>op 'n voorwerp is gelyk aan die verandering in die voorwerp se kinetiese energie</u> \checkmark | (2) |
| | 5.3.2 $W_{\text{net}} = \Delta E_K \checkmark$ $W_f = E_{Kf} - E_{Ki} \checkmark$ $F_f \Delta x \cos\theta = \frac{1}{2} mv_f^2 - \frac{1}{2} mv_i^2 \checkmark$ $6\,000(\Delta x) \cos 180^\circ \checkmark = \frac{1}{2} (800)(0) - \frac{1}{2} (800)(20,5)^2 \checkmark$ $-6000 \Delta x = -168\,100$ The braking distance/ Remafstand = $\Delta x = 28,02 \text{ m} \checkmark$ | (5) |

| | | | |
|-----|-------|---|-----|
| 5.4 | 5.4.1 | $W_{\text{net}} = \Delta E_K \checkmark$ $= \frac{1}{2} m(v_f^2 - v_i^2)$ $= \frac{1}{2} (80)(25^2 - 0^2) \checkmark$ $= 40(625)$ $= 25\,000 \text{ J} \checkmark$ $= 25 \text{ kJ}$ | (3) |
| | 5.4.2 | $f_k = \mu_k F_N \checkmark$ $= 0,34(mg \cos\theta)$ $= \underline{0,34 \times 80 \times 9,8} \checkmark \times \frac{1,09}{1,20} \checkmark$ $= 242,13 \text{ N} \checkmark$ | (4) |
| | 5.4.3 | | (4) |
| | 5.4.4 | <p>OPTION/OPSIE 1</p> $W_{\text{net}} = W_{\text{App}} + W_{//} + W_f$ $= F_{\text{app}}\Delta x \cos\theta + F_{G//}\Delta x \cos\phi + F_f\Delta x \cos\phi$ $= F_{\text{app}}\Delta x \cos\theta + mg \sin\delta \Delta x \cos\phi + F_f\Delta x \cos\phi$ $= 450 \times 1,2 \times \cos 0^\circ + 80 \times 9,8 \times \frac{0,5}{1,2} \times 1,2 \times \cos 180^\circ + 242,13 \times 1,2 \times \cos 180^\circ$ $= 450 \times 1,2 \times 1 + 80 \times 9,8 \times \frac{0,5}{1,2} \times 1,2 \times -1 \checkmark + 242,13 \times 1,2 \times -1 \checkmark$ $= 540 - 392 - 290,56$ $W_{\text{net}} = -142,56 \text{ J} \checkmark$ <p>OPTION/OPSIE 2</p> $F_{\text{net}} = F_{\text{app}} + F_{G//} + F_f$ $= F_{\text{app}} + mg \sin\delta + F_f$ $= 450 - (80 \times 9,8 \times \frac{0,5}{1,2} + 242,13) \checkmark$ $= -118,80 \text{ N}$ $W_{\text{net}} = F_{\text{net}}\Delta x \cos\theta$ $= 118,80 \times 1,2 \times -1 \checkmark$ $= -142,56 \text{ J} \checkmark$ <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-top: 10px;"> \checkmark for any of the two vir enige van die twee </div> | (4) |
| | 5.4.5 | $E_P = mgh \checkmark_s$ $= 80 \times 9,8 \times 0,5 \checkmark$ $= 392 \text{ J} \checkmark$ | (3) |

[35]

QUESTION/VRAAG 6

| | | | |
|-----|-------|---|-----|
| 6.1 | 6.1.1 | <p>Doppler effect is the <u>change in frequency (or pitch) of the sound detected</u> ✓ by a listener, because <u>the sound source and the listener have different velocities relative to the medium of sound propagation</u> ✓.</p> <p>OR</p> <p>Doppler effect is the <u>apparent change in frequency of a wave</u> ✓ when there is <u>relative motion between the source and an observer</u> ✓.</p> <p>OR</p> <p>Doppler Effect is an <u>(apparent) change in observed/detected frequency (pitch), (wavelength)</u> ✓ as a result of the relative motion between a source and an observer (listener) ✓.</p> <p><i>Die Doppler effek is die <u>verandering in frekwensie (of toonhoogte) van die klank waargeneem</u> ✓ deur 'n <u>luisteraar want dit klankbron en luisteraar het verskillende snelhede relatief tot die medium van die voortplanting van die klank.</u> ✓</i></p> <p>OF</p> <p><i>Die Doppler effek is die <u>skynbare verandering in die frekwensie van 'n golf</u> ✓ as <u>daar relatiewe beweging is tussen die bron en die waarnemer.</u> ✓</i></p> <p>OF</p> <p><i>Die Doppler effek is 'n <u>waarskynlike verandering in die waargenome frekwensie (toonhoogte)(golflengte)</u> ✓ as gevolg van die relatiewe beweging tussen die bron en die luisteraar ✓</i></p> | (2) |
| | 6.1.2 | <p>Towards the Listener. (<i>Na die luisteraar</i>) ✓</p> <p>The frequency of the sound waves heard by the listener is greater than the frequency of the sound waves emitted by the ambulance. ✓</p> <p>The <u>compressions in front of the source are closer together because the source is moving towards the previously emitted wavefront when the next wavefront is sent</u> ✓ resulting in a <u>decrease in wavelength</u> ✓ and a sound of higher pitch is heard.</p> <p><i>Die frekwensie van die klankgolwe gehoor deur die luisteraar is hoër as die frekwensie van die klankgolwe uitgestraal deur die ambulans. ✓</i></p> <p><i>Die samepersing aan die voorkant van die bron is nader aanmekaar want die bron beweeg na die uitgestraalde golffront wanneer die vorige golffront gestuur word ✓ en veroorsaak 'n afname in die golflengte en die hoër toonhoogte word gehoor. ✓</i></p> | (4) |
| | 6.1.3 | $f_L = \frac{v \pm v_L}{v \pm v_s} f_s \quad \checkmark$ $\checkmark 400 = \frac{340}{340 - v_s} 350 \quad \checkmark$ $340 - v_s = \frac{340}{400} 350$ $v_s = 42,5 \text{ m} \cdot \text{s}^{-1} \quad \checkmark$ | (4) |

QUESTION/VRAAG 7

| | | | |
|-----|-------|---|-----|
| 7.1 | 7.1.1 | <p>The magnitude of the <u>electrostatic force</u> exerted by one point charge (Q_1) on another point charge (Q_2) <u>is directly proportional to the product of the charges</u> ✓ and <u>inversely proportional to the square of the distance (r) between them.</u> ✓</p> <p>OR</p> <p>The magnitude of the <u>electrostatic force</u> between two point charges <u>is directly proportional to the product of the magnitudes of the charges</u> ✓ and <u>inversely proportional to the square of the distance between them.</u> ✓</p> <p><i>Die grootte van die <u>elektrostatiese krag</u> wat deur een puntlading (Q_1) op 'n ander puntlading (Q_2) uitoefen, is direk eweredig aan die grootte van die produk van die lading ✓ en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle. ✓</i></p> <p>OF</p> <p><i>Die grootte van die <u>elektrostatiese krag</u> tussen twee puntladings is direk eweredig aan die produk van die massas van die ladings ✓ en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle. ✓</i></p> | (2) |
| | 7.1.2 | <p>Electrostatic force exerted by Q_1 on Q_2/ <i>Elektrostatiese krag uitgeoefen deur Q_1 op Q_2:</i></p> $F = k \frac{Q_1 Q_2}{r^2} \checkmark$ $= \frac{(9 \times 10^9)(4 \times 10^{-9})(2 \times 10^{-9})}{0,04^2} \checkmark$ $= 4,5 \times 10^{-5} \text{ N, to the East/na die Ooste}$ <p>Electrostatic force exerted on Q_2 by Q_3/ <i>Elektrostatiese krag uitgeoefen deur Q_2 op Q_3:</i></p> $F = k \frac{Q_2 Q_3}{r^2}$ $= \frac{(9 \times 10^9)(2 \times 10^{-9})(6 \times 10^{-9})}{0,06^2} \checkmark$ $= 3,0 \times 10^{-5} \text{ N, to the East}$ <p>Both forces are towards the same direction/ <i>Albei kragte is in dieselfde rigting:</i></p> <p>The net electrostatic force/ <i>Die netto elektrostatiese krag</i> $F_{\text{net}} = 4,5 \times 10^{-5} \text{ N} + 3,0 \times 10^{-5} \text{ N} \checkmark$ $= 7,5 \times 10^{-5} \text{ N} \checkmark$ (To the East)</p> | (7) |

[9]

TOTAL/TOTAAL: 150