Province of the
EASTERN CAPE
EDUCATION

OR TAMBO INLAND DISTRICT

GRADE 11

PHYSICAL SCIENCES: PHYSICS (P1)

JUNE 2023

MARKS: 100

TIME: 2 HOURS

This question paper consists of 14 pages, including 2 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your FULL NAME and SURNAME on the ANSWER SCRIPT.
2. The question paper consists of 8 questions. Answer ALL the questions in the ANSWER SCRIPT.
3. Start EACH question on a new page in the ANSWER SCRIPT.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE-line open between two sub-questions for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEETS.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your final numerical answers to a minimum of TWO decimal places.
11. Give brief explanations, motivations, et cetera where required.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A–D) next to the question number (1.1–1.10) in the ANSWER BOOK, for example 1.11 E

1.1 Which one of the following is an example a scalar quantity?

A Velocity

B Mass

C Acceleration

D Force of gravity. (2)

1.2 The frictional force acting on a sliding object by the surface in contact with it ...

A depends on air resistance.

B depends on the normal force.

C depends on the area of contact.

D does not depend on the type of surface. (2)

1.3 A satellite orbits Earth at a height where the gravitational force is a quarter (¼) of the force it experiences on the surface of the Earth. If the radius of Earth is **R**, the height of the satellite ABOVE THE SURFACE of Earth is …

A 4**R**

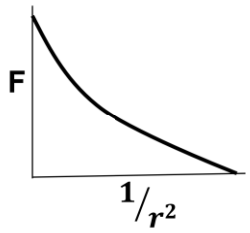
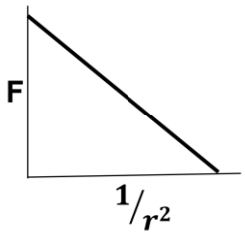
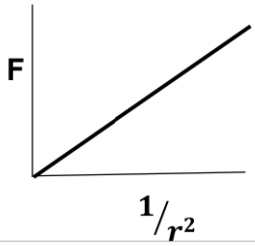
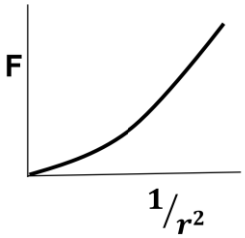
B 2**R**

C **R**

D ½**R** (2)

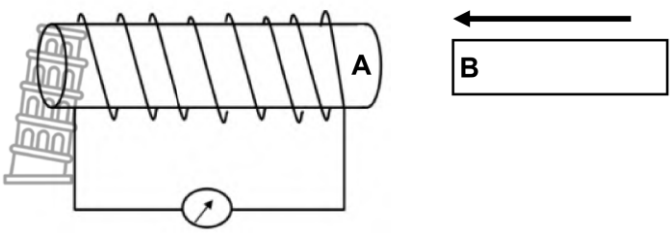
1.4 State Coulomb's law states that the magnitude of the electrostatic force exerted by two point charges (Q_1 and Q_2) on each other is directly proportional to the product of the magnitudes of the charges and inversely proportional to the square of the distance (r) between them.

Which of the following graphs best describe the relationship between electrostatic force and the inverse of the distance between two charges?

A		B	
C		D	

(2)

1.5 In the diagram below, a bar magnet is being pushed into a coil. The current induced in the coil is in the direction indicated.



Which ONE of the following combinations correctly shows the polarity of the end of the coil facing the bar magnet, as the bar magnet approaches the coil and which end of the bar magnet is approaching the coil.

	Polarity of the coil facing the bar magnet (A)	**End of the bar magnet approaching the coil (B)**
A	North pole	South pole
B	South pole	South pole
C	South pole	North pole
D	North pole	North pole

(2)

1.6 Two bulbs **A** (500 W) and **B** (200 W) are both rated to function at 250 V. What is the ratio of the resistances (R_A:R_B) for bulbs **A** and **B**?

A 25:4

B 4:25

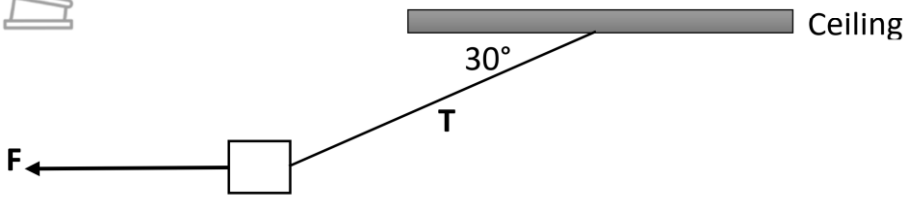
C 5:2

D 2:5 (2)

[12]

QUESTION 2

A box, weight 55 N, is suspended from the ceiling by a string. A horizontal force **F** is then applied to the box to keep it in EQUILIBRIUM when the string makes an angle of 30° with the Ceiling. The tension in the string is **T**.



2.1 Explain what is meant if the box is in equilibrium. (2)

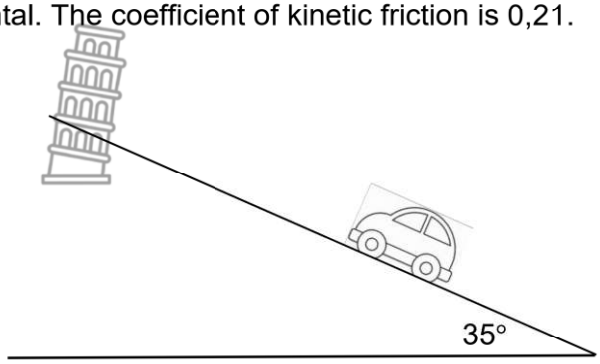
2.2 Draw a closed vector diagram of the three forces **T**, **F** and **w** by using the tail-to-head method. Clearly label the three forces and the relevant angle. (3)

2.3 Calculate the magnitudes of **F** and **T**. (4)

[09]

QUESTION 3

A car with a mass of 350 kg is accelerated up along a straight hill by a NET force of 370 N. The net force is parallel to the hill, which makes an angle of 35° with the horizontal. The coefficient of kinetic friction is 0,21.



3.1 Draw a free-body diagram, with labels, of all the forces acting on the car. (4)

3.2 Calculate the magnitude of the:

3.2.1 Acceleration of the car (3)

3.2.2 Force of friction on the car (4)

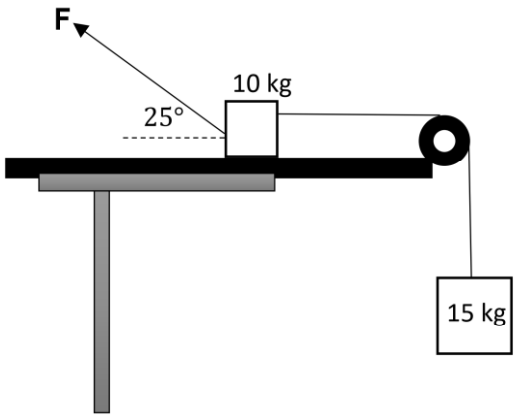
3.2.3 Applied force on the car (3)

[14]

QUESTION 4

A 10 kg block, resting on a rough horizontal surface, is connected to block of 15 kg by a light inextensible string moving over a frictionless pulley.

Due to the weight acting on a 15 kg block, the block of mass 10 kg started to move to the right. A force of **F** is applied to a 10 kg block such that the system moves at s CONSTANT SPEED. The angle between the applied force and the horizontal is 25°.



The frictional force acting on a 10 kg block is 8 N.

4.1 State Newton's Second law of motion in words. (2)

4.2 Write the net force acting on the system. (1)

4.3 Calculate the magnitude of the:

4.3.1 Tension on a 15 kg block. (2)

4.3.2 Force applied, **F**. (4)

4.3.3 coefficient of the kinetic frictional force acting on a 10 kg block (4)

[13]

QUESTION 5

A satellite, mass 380 kg, is in a circular orbit a certain height above the surface of the earth. The earth exerts a gravitational force of 2,65 x 10^3 N on the satellite to keep it in its orbit.

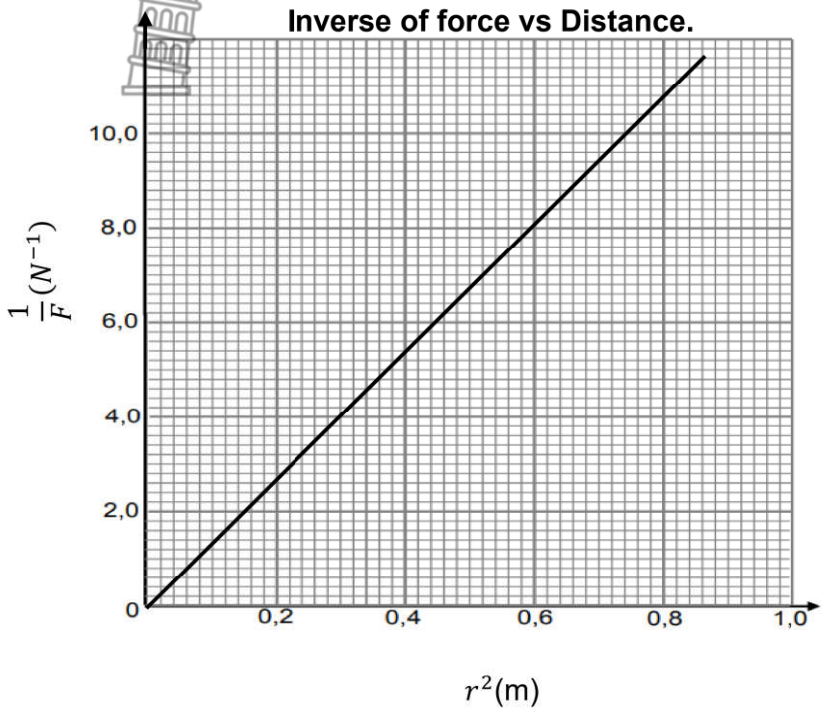
5.1 State Newton's Law of Universal Gravitation in words. (2)

5.2 Calculate the height, in km, of the satellite above the surface of the earth. (5)

[07]

QUESTION 6

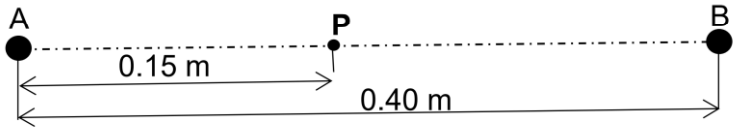
6.1 A class of Grade 11 leaners wanted to investigate the relationship between the inverse of an electrostatic force and the distance between two identical charges. They carried their experiment and recorded the results. The graph bellow shows the results obtained by the learners.



6.1.1 Using the graph, write down the relationship between the distance between the inverse of force and the distance between the charges. (1)

6.1.2 Determine the magnitude of each charge. (6)

6.2 In the diagram below, point charge B has a charge of –6 nC and point charge A has an unknown charge. Charge A is 0.40 m away from charge B. P is the point that is placed 0.15 m away from A.



The net electric field at point P due to point charges A and B is 6 x 10^5 N.C^{-1}, to the left.

6.2.1 Is sphere A, POSITIVE or NEGATIVE? (1)

6.2.2 Draw an electric field pattern between charge A and B. (3)

6.2.3 Calculate the magnitude of the charge on sphere A. (6)

[17]

QUESTION 7

Consider a solenoid of 9 turns with unknown radius, r. The solenoid is subjected to a magnetic field of 0,12 T. The face of the solenoid is perpendicular to the magnetic field. When the field is uniformly switched to 12 T over a period of 2 minutes an emf with a magnitude of −0,3 V is induced.

7.1 State Faraday's law of electromagnetic induction in words. (2)

7.2 Calculate:

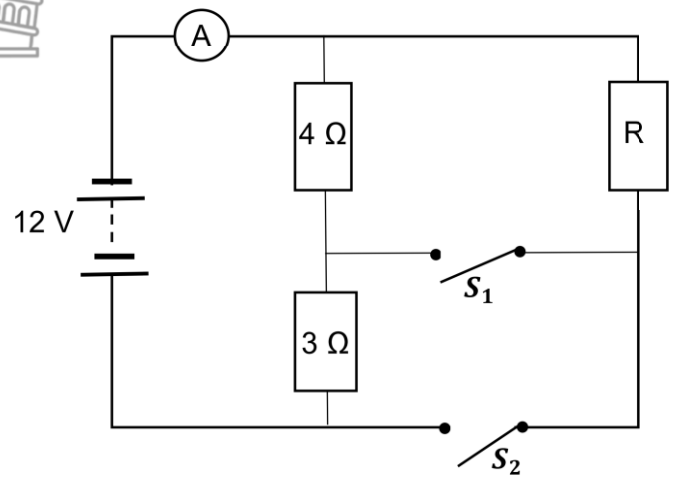
7.2.1 the change in magnetic flux. (4)

7.2.2 the radius of the solenoid. (4)

[10]

QUESTION 8

8.1 The circuit below consists of a 4 Ω and 3 Ω resistor and an unknown resistor R. The potential difference across the battery is 12 V. An ammeter, a high-resistance voltmeter, two open switches **S_1** and **S_2** and battery are connected, as shown. The resistance of the battery and wires can be ignored.



When only switch **S_1** is closed, the power dissipated on a 4 Ω resistor is 9 W.

8.1.1 Calculate the potential difference across the 4 Ω resistor. (3)

8.1.2 Determine the ammeter reading. (4)

8.1.3 Calculate the value of the unknown resistor R. (5)

Switch **S_1** is now opened and **S_2** is closed.

8.1.4 Using the resistor calculated in 8.1.3, calculate the effective resistance of the circuit. (2)

8.2 A motor, labelled 1 500 W, is used for an average of 3 hours per day. The cost of electricity is R 2.60 per kWh.

8.2.1 Calculate the energy used by the motor for 3 hours per day in kWh. (2)

8.2.2 Calculate the cost of electricity to operate the moto for a month with 30 days. (2)

[18]

TOTAL: 100

DATA FOR PHYSICAL SCIENCES GRADE 11

PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	$9{,}8\ m{\cdot}s^{-2}$
Gravitational constant *Swaartekragkonstante*	G	$6{,}67 \times 10^{-11}\ N{\cdot}m^2{\cdot}kg^{-2}$
Radius of Earth *Radius van die Aarde*	R_E	$6{,}38 \times 10^{6}\ m$
Coulomb's constant *Coulomb se konstante*	k	$9{,}0 \times 10^{9}\ N{\cdot}m^2{\cdot}C^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3{,}0 \times 10^{8}\ m{\cdot}s^{-1}$
Charge on electron *Lading op elektron*	e	$-1{,}6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9{,}11 \times 10^{-31}\ kg$
Mass of Earth *Massa van die Aarde*	M	$5{,}98 \times 10^{24}\ kg$

TABLE 2: FORMULAE

FORCE

$F_{net} = ma$	$w = mg$
$F = \frac{Gm_1m_2}{r^2}$	$\mu_s = \frac{f_{s(max/maks)}}{N}$
$\mu_k = \frac{f_k}{N}$	

ELECTROSTATICS

$F = \frac{kQ_1Q_2}{r^2}$ $(k = 9{,}0 \times 10^{9}\ N{\cdot}m^2{\cdot}C^{-2})$	$E = \frac{F}{q}$
$E = \frac{kQ}{r^2}$ $(k = 9{,}0 \times 10^{9}\ N{\cdot}m^2{\cdot}C^{-2})$	$n = \frac{Q}{e}$

ELECTROMAGNETISM

$\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$	$\Phi = BA\cos\theta$

ELECTRICITY

$I = \frac{Q}{\Delta t}$	$R = \frac{V}{I}$
$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} + \ldots$	$R = r_1 + r_2 + r_3 + \ldots$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P = \frac{V^2}{R}$

Province of the
EASTERN CAPE
EDUCATION

O.R TAMBO INLAND DISTRICT

GRADE 11

PHYSICAL SCIENCES: PHYSICS (P1)

JUNE 2023 EXAMINATIONS

MEMORANDUM

MARKS: 100

THIS MEMORANDUM CONSISTS OF SEVEN PAGES

QUESTION 1

1.1 B✓✓ (2)

1.2 B✓✓ (2)

1.3 C✓✓ (2)

1.4 C✓✓ (2)

1.5 B✓✓ (2)

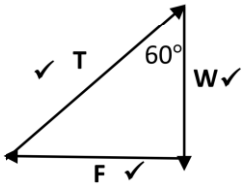
1.6 C✓✓ (2)

[12]

QUESTION 2

2.1 The resultant of the force is zero.✓✓ (2)

2.2



(3)

2.3

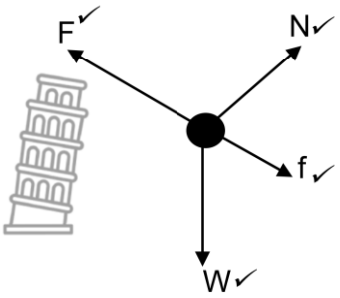
Option 1	Option 2
$\tan 60° = \frac{F}{55}$✓	$\tan 30° = \frac{55}{F}$✓
F = 55 tan 60°	$F = \frac{55}{\tan 30°}$
= 95.26 N✓	= 95.26 N✓
$\cos 60° = \frac{55}{T}$✓	$\sin 30° = \frac{55}{T}$✓
$T = \frac{55}{\cos 60}$	$T = \frac{55}{\sin 30°}$
= 110 N✓	= 110 N✓

(4)

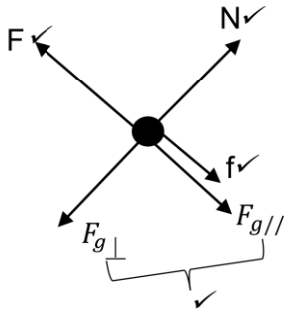
[09]

QUESTION 3

3.1



OR



(4)

3.2.1 $F_{net} = ma$✓
$370 = 350\ a$✓
$a = 1.06\ m.s^{-2}$✓ (3)

3.2.2 $f_k = \mu_k N$✓
$f_k = (0.21)$✓$(350)(9.8)\cos 35°$✓
$= 590.04\ N$✓ (4)

3.2.3 $F_{net} = ma$
$F - f - F_{g//} = ma$
$F - 590.04 - (350)(9.8)\sin 30°$✓ $= 370$✓
$F = 1\ 494.96\ N$✓ (3)

[14]

QUESTION 4

4.1 When a resultant/net force acts on an object, the object will *accelerate in the direction of the force at an acceleration directly proportional to the force* ✓and *inversely proportional to the mass* ✓of the object. (2)

4.2 0/zero✓ (1)

4.3.1 $F_{net} = ma$
$W - T = 0$
$(15)(9.8)$✓ $= T$
$T = 147\ N$✓ (2)

4.3.2 $F_{net} = ma$
$T - Fx - f$ ✓$= ma$
$147 - F\cos 25°$✓ $- 8 = 0$✓
$F = 153.37\ N$✓ (4)

4.3.3 $F_N + Fy = F_g$
$F_N = (10)(9.8)$✓ – $(153.37)\sin 25°$✓
$F_N = 33.18$ N
$f_k = \mu_k N$✓
$8 = \mu_k(33.18)$
$\mu_k = 0.24$✓ (4)

[13]

QUESTION 5

5.1 Each particle in the universe attracts every other particle with a *gravitational force that is directly proportional to the product of their masses*✓ and *inversely proportional to the square of the distance between their centres*.✓ (2)

5.2 $F = \frac{GQ\ m_1\ m_2}{r^2}$ ✓

2.65×10^3✓ $= \frac{(6.67 \times 10^{-11})(5.98 \times 10^{24})(380)}{r^2}$ ✓

$r = 7.56 \times 10^6$ m

distance = 7.56×10^6 m – 6.38×10^6 m✓
= 1.18×10^6 m✓ (5)

[07]

QUESTION 6

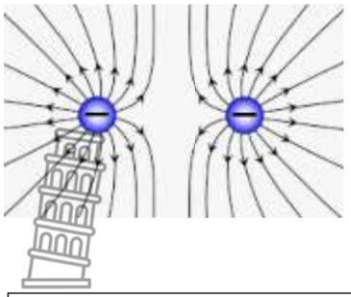
6.1.1 Inverse of force is directly proportional to the square distance between the charges.✓ (1)

6.1.2 gradient = $\frac{\Delta^1/_F}{r^2}$ ✓
$= \frac{8.0-0}{0.6-0}$ ✓
$= 13.33$

$F = \frac{k\ Q_1\ Q_2}{r^2}$ ✓
$Fr^2 = k\ Q_1\ Q_2$
$\frac{1}{13.33}$ ✓$= (9.0 \times 10^9)Q^2$✓
$Q = 2.89 \times 10^3$ C✓ (6)

6.2.1 NEGATIVE✓ (1)

6.2.2



Shape	✓
Lines not touching/ crossing each other	✓
Direction of arrows	✓

(3)

6.2.3 $E_A = \frac{k\,Q_A}{r^2}$ ✓

$= \frac{(9\times10^9)\times Q_A}{(0.15)^2}$ ✓

$E_B = \frac{k\,Q_B}{r^2}$

$= \frac{(9\times10^9)\times(6\times10^{-9})}{(0.25)^2}$ ✓

$= 864\ \text{N.}C^{-1}$

$E_A - E_B = E_{net}$

$\frac{(9\times10^9)\times Q_A}{(0.15)^2} - 864$ ✓ $= 6\times10^5$ ✓

$\frac{(9\times10^9)\times Q_A}{(0.15)^2} = 600864$

$Q_A = 1.50\times10^{-6}$ C ✓

(6)

[17]

QUESTION 7

7.1 The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor.✓✓ (2)

7.2.1 $\varepsilon = -N\frac{\Delta\emptyset}{\Delta t}$✓

0.3✓ $= -(9)\ \frac{\Delta\emptyset}{2\times60}$✓

$\Delta\emptyset$ = 4 Wb✓ (4)

7.2.2 $\Delta\emptyset = (B_f - B_i)A.Cos\theta$✓

4 $= (12 - 0.12)$✓$\pi r^2 Cos0^\circ$✓

r = 0.33 m ✓ (4)

[10]

QUESTION 8

8.1.1 $I = \frac{V^2}{R}$ ✓

$9 = \frac{V^2}{4}$✓

V = 6 V✓ (3)

8.1.2 $V_{3\Omega}$ = 12 V – 6 V

= 6 V✓

$R = \frac{V}{I}$ ✓

$3 = \frac{6}{I}$ ✓

I = 2 A✓ (4)

8.1.3

$I_4 = \frac{V}{R}$	OR	$P = I^2R$	OR	$P = VI$
$= \frac{6}{4}$ ✓		$9 = I^2(4)$✓		$9 = 6I$✓
= 1.5 A✓		I = 1.5 A✓		I = 1.5 A✓

I_R = 2 A – 1.5 A

= 0.5 A✓

V_R = 6 V

$R = \frac{V}{I}$

$= \frac{6}{0.5}$ ✓

= 12 Ω✓ (5)

8.1.4

Option 1	Option 2
$R_{//} = \frac{R_1 \times R_2}{R_1 + R_2}$ $= \frac{(4+3)\times 12}{(4+3)+12}$ ✓ = 5.15 Ω ✓	$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$ $\frac{1}{R_P} = \frac{1}{4+3} + \frac{1}{12}$ ✓ R_P = 5.15 Ω ✓

(2)

8.2.1 E = P × Δt

$= \frac{1500}{1000} \times 3$✓

= 4.5 kWh✓ (2)

8.2.2 Energy per month = 4.5 kWh × 30

= 135 kWh✓

Cos = 135 × 2.60

= R 351✓ (2)

[18]

TOTAL: 100