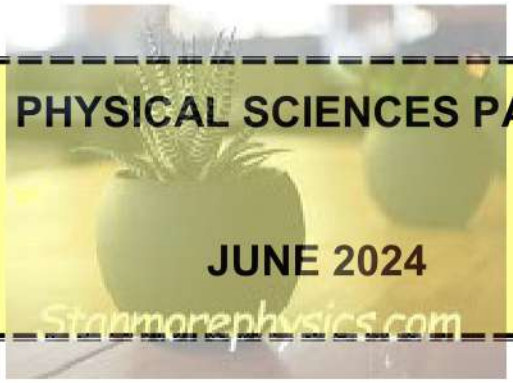
Province of the
EASTERN CAPE
EDUCATION

OR TAMBO INLAND DISTRICT

GRADE 10



PHYSICAL SCIENCES PAPER

JUNE 2024

MARKS: 100

TIME: 2 HOURS

THIS QUESTION PAPER CONSISTS OF 12 PAGES INCLUDING THE COVER PAGE.

INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate space on the ANSWER BOOK.
2. This question paper consists of 5 questions. Answer ALL the questions.
3. Start each question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. USE the DATA SHEETS that are attached.
8. Show ALL formulae and substitutions in ALL calculations.
9. Round off your final numerical answers to a **minimum of TWO** decimal places.
10. Detach the graph paper and submit it with your answer booklet.
11. 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. Write only the letter (A – D) next to the question numbers (1.1 to 1.8) in the ANSWER BOOK, e.g. 1.9 E.

1.1 The process whereby a gas changes directly into a solid is called:

A. Sublimation
B. Evaporation
C. Deposition
D. Condensation (2)

1.2 Which ion is represented by the following electronic configuration $1s^2 2s^2 2p^6$?

A. Mg
B. Ca^{2+}
C. F
D. Mg^{2+} (2)

1.3 Which one of the elements below is a metalloid?

A. Al
B. Cu
C. O
D. B (2)

1.4 50 g of a certain compound boils at 65°C. At what temperature will 100g of the same substance boil?

A. −65°C
B. 130°C
C. 65°C
D. −130°C (2)

1.5 A bond in which a sea of delocalised electrons form around positive ions is a/an…

A. Covalent bond.
B. Metallic bond.
C. Ionic bond.
D. Delocalised bond. (2)

[10]

QUESTION 2 (Start on a new page)

2.1 The table below shows the melting points and boiling points of substances A to D.

SUBSTANCE	BOILING POINT (°C)	MELTING POINT (°C)
A	78	-177
B	444	133
C	-188	-220
D	184	90

2.1.1 Define the term boiling point. (2)

From the table above, write down the letter (A – D) that represents the substance which is a:

2.1.2 liquid at 100°C. (1)

2.1.3 solid at 100°C. (1)

2.1.4 gas at 25°C. (1)

2.2 Grade 10 learners in Madiba High school place a solid substance, S on a hot plate and heat it uniformly at a constant rate. The table below shows the temperatures of the object at various times during the experiment:

Time (minutes)	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70
Temperature(°C)	0	10	20	20	20	30	40	50	60	70	80	80	80	95	110

2.2.1 Write down a suitable aim for this experiment. (1)

2.2.2 Draw a graph of temperature against time for the data in the table on the attached graph sheet. (4)

2.2.3 Why does temperature remain constant from 10 to 20 minutes? (2)

2.2.4 Write down the boiling point of this substance. (1)

2.2.5 What is the phase of this substance after 65 minutes? (1)

2.2.6 What happens to the potential energy of the particles of this substance from 50 to 60 minutes? Write down increases, decreases or remains the same. (1)

2.3 The following substances are given: S_8, water, ethanol, cooking oil, Cl_2 :

2.3.1 Define a pure substance. (2)

2.3.2 Write down an element from the list of substances in 2.3. (1)

2.3.3 Which type of mixture is obtained when water is mixed thoroughly with ethanol? (1)

[19]

QUESTION 3 (Start on a new page)

3.1 An element X has three isotopes. The table below shows the masses and the percentage abundances of the three isotopes.

Isotopes of X	Masses	% abundance
1	56	91,75%
2	54	5,86%
3	57	2,39%

3.1.1 Define the term isotope. (2)

3.1.2 Calculate the relative atomic mass of element X. (4)

3.1.3 Using the periodic table as reference, write down the **chemical name** of element X by rounding off the answer obtained in 3.1.2 to the nearest whole number. (1)

3.2 Potassium has an atomic number of 19.

3.2.1 How many electrons does potassium have? (1)

3.2.2 How many neutrons does potassium have? (1)

3.2.3 How many valence electrons does potassium have? (1)

3.2.4 What name is given to the group on the periodic table in which potassium can be found? (2)

3.3 Write down the chemical formula of calcium sulphate. (2)

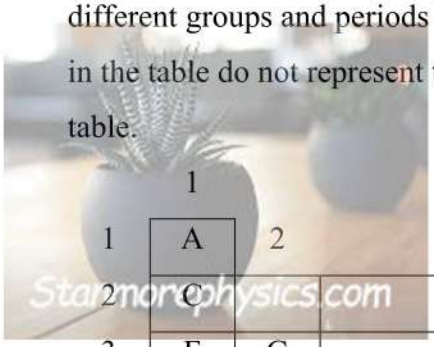
3.4 Write down the chemical name of $Pb(NO_3)_2$. (2)

3.5 Draw the aufbau diagram (orbital box diagram) of the electron configuration of phosphorus. (2)

[18]

QUESTION 4 (Start on a new page)

4.1 A section of the periodic table has been drawn in the table below. The elements in the different groups and periods have been represented by the letters A to L. The letters in the table do not represent the actual chemical symbols of elements in the periodic table.



	1								18
1	A	2			13	14	15	16	17	B
2	C					D			E	
3	F	G								K
4	L									

Write down the letter that represents an element which:

4.1.1 is in period 2 that will form an X^- ion. (1)

4.1.2 has a fully filled orbital. (1)

4.1.3 is a noble gas. (1)

4.1.4 has the smallest atomic radius in period 2. (1)

4.1.5 has the lowest ionisation energy in group 1. (1)

4.1.6 is a halogen. (1)

4.2 Define the term ionisation energy. (2)

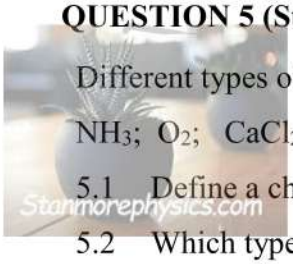
4.3 What is the general trend in ionisation energy from left to right across the period on the periodic table?

Write down increases, decreases or remains the same.

Give an explanation for your answer. (3)

[11]

QUESTION 5 (Start on a new page)



Different types of chemical bonds are formed in the following chemical substances:

NH_3; O_2; $CaCl_2$; Fe.

5.1 Define a chemical bond. (2)

5.2 Which type of bond exists between atoms/molecules of:

5.2.1 NH_3 (1)

5.2.2 $CaCl_2$ (1)

5.2.3 Fe (1)

5.3 Draw the Lewis dot diagram of NH_3 and $CaCl_2$. (4)

5.4 Define a physical change. (2)

5.5 Iron reacts with oxygen to form iron (III) oxide.

5.5.1 Is the above reaction an example of a physical or chemical change? (1)

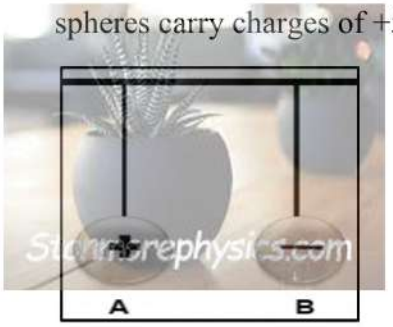
5.5.2 Using chemical formula, write down a complete balanced chemical equation for the reaction in 5.5.1 (3)

5.5.3 Prove that mass is conserved in the reaction in 5.5.2 (3)

[18]

QUESTION 6 (Start on a new page)

Two identical insulated spheres, A and B, suspended by threads from a ceiling, are held at a small distance apart, as shown in the diagram below. The spheres carry charges of +5 nC and -2 nC respectively.



6.1 State the Principle of Conservation of Charge. (2)

6.2 Is there a SHORTAGE or EXCESS of electrons on the -2 nC object before contact? (1)

6.3 The two spheres are brought into contact and then separated again.

6.3.1 In what direction will electrons be transferred during contact? Write only FROM A TO B or FROM B TO A. (1)

6.3.2 Apply the principle of conservation of charge in order to calculate the new charge on the objects after separation. (3)

6.3.3 Calculate how many electrons are on each object after contact (3)

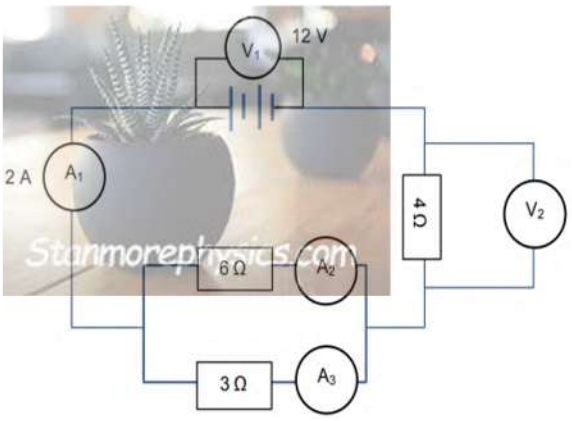
6.4 A charged ruler is brought closer to neutral pieces of paper. The pieces of paper are attracted to the ruler, as shown below.

6.4.1 Explain why the pieces of paper are attracted to the ruler. (2)

[12]

QUESTION 7 (Start on a new page)

In the circuit diagram below the reading on voltmeter V_1 is 12 V and the reading on ammeter A_1 is 2 A.



7.1 Define the term potential difference (2)

7.2 Calculate the:

7.2.1 Total resistance of the circuit (4)

7.2.2 Reading on V_2 (3)

If a third resistor (1,5 Ω) is placed in parallel with the existing resistors in Circuit A, would the total current in the circuit INCREASE, DECREASE or REMAIN THE SAME? Explain the answer. (3)

[12]

TOTAL **100**

ELECTROSTATICS/*ELEKTROSTATIKA*

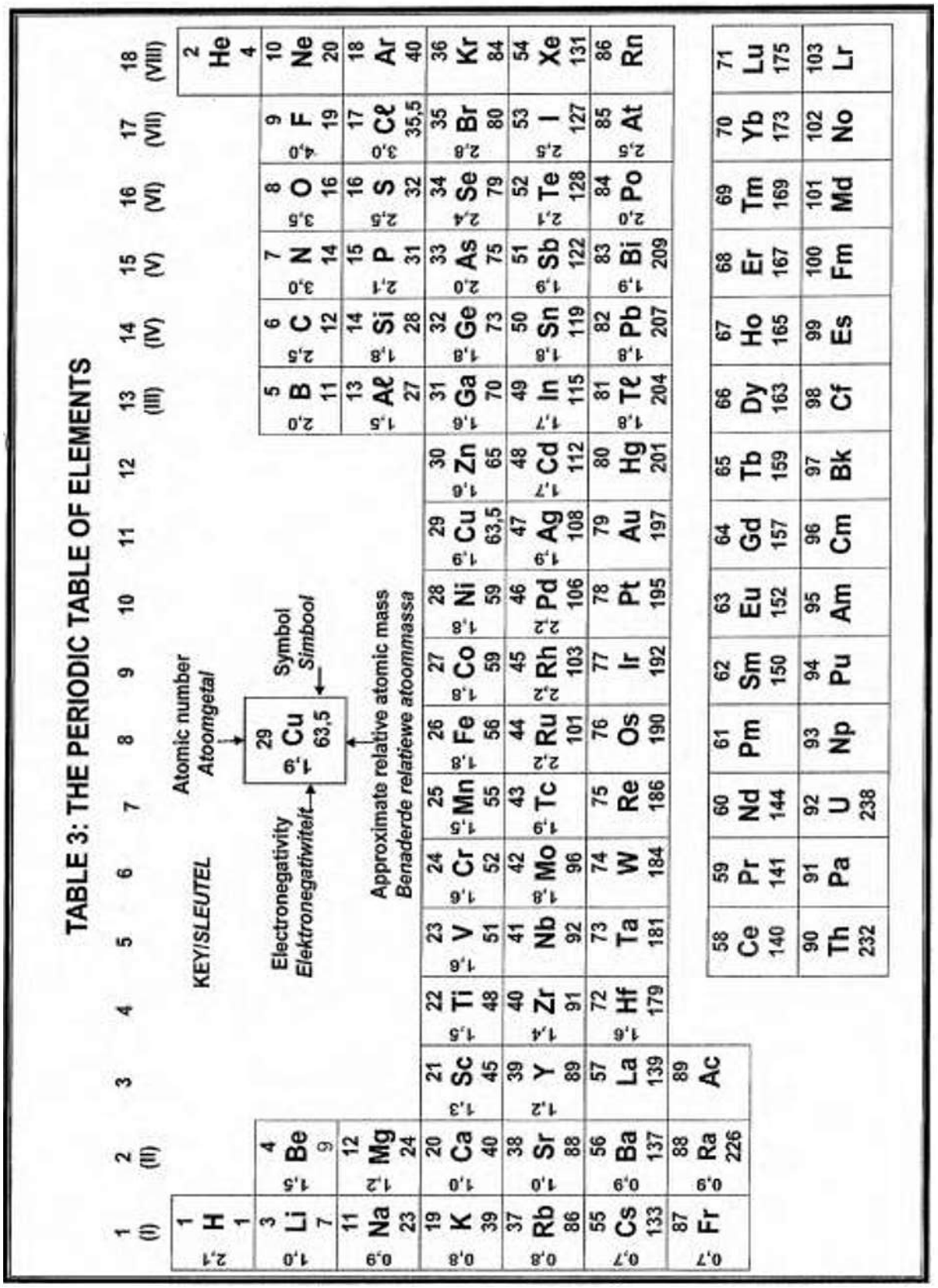
$n = \frac{Q}{e}$	$Q = \frac{Q_1 + Q_2}{2}$

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$Q = I \Delta t$	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$
$R_s = R_1 + R_2 + \ldots$	$V = \frac{W}{q}$

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

TABLE 1: PERIODIC TABLE



GRAPH PAPER FOR QUESTION 2.2.2 (DETACH AND SUBMIT)

LEARNER NAME AND SURNAME: _____

TEMPERATURE (°C)

TIME (MIN)

Province of the
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JUNE 2024

MEMORANDUM

MARKS: 97

THIS MEMORANDUM CONSISTS OF 8 PAGES INCLUDING THE COVER PAGE.

QUESTION 1

1.1 C✓✓ (2)

1.2 D✓✓ (2)

1.3 D✓✓ (2)

1.4 C✓✓ (2)

1.5 B✓✓ (2)

QUESTION 2

2.1.1 The temperature at which the vapour pressure of a substance equals the external (atmospheric) pressure. ✓✓ (2)

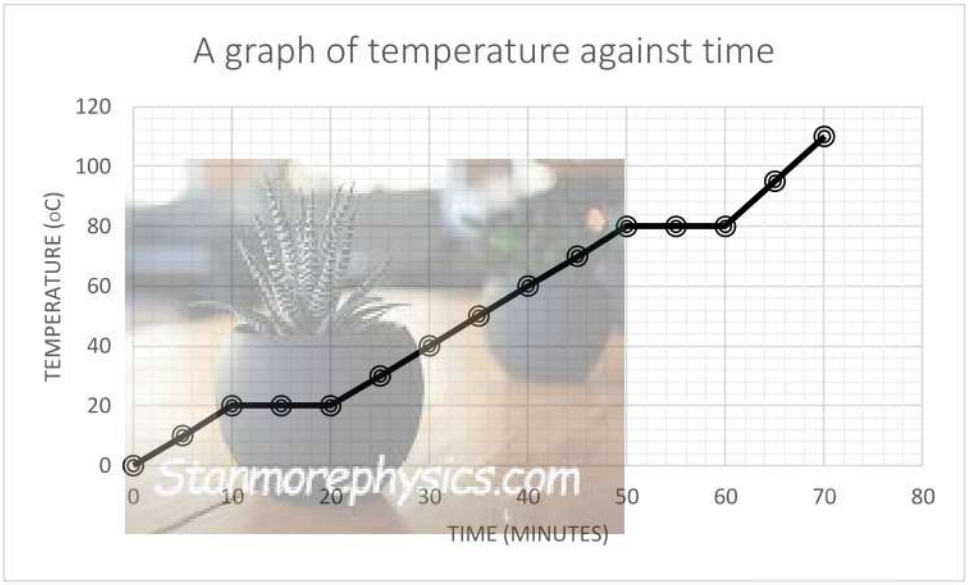
2.1.2 D✓ (1)

2.1.3 B✓ (1)

2.1.4 C✓ (1)

2.2.1 To determine the heating curve of substance S. ✓ OR
To determine how temperature changes over time as substance S is heated. ✓ (1)

2.2.2



Correctly plotted points for 0 to 20 minutes ✓
Correctly plotted points for 20 to 50 minutes ✓
Correctly plotted points for 50 to 70 minutes ✓
Shape of graph ✓

(4)

2.2.3 The heat supplied is used to overcome the intermolecular forces ✓between the solid molecules converting them from a solid to a liquid✓. (2)

2.2.4 80°C ✓ (1)

2.2.5 Gas ✓ (1)

2.2.6 Increases ✓ (1)

2.3.1 A substance that cannot be separated into simpler components by physical methods. ✓✓ (2)

2.3.2 S_8 or Cl_2 Any one ✓ (1)

2.3.3 Homogeneous mixture ✓ (1)

[19]

QUESTION 3

3.1.1 Atoms of the same element having the same number of protons but different number of neutrons. ✓✓ (2)

3.1.2 $Ar = \frac{56\times91,75}{100}$ ✓ $+ \frac{54\times5,86}{100}$ ✓ $+ \frac{57\times2,39}{100}$ ✓ $= 55,91.$ ✓ (4)

3.1.3 Iron ✓ (1)

3.2.1 19 ✓ (1)

3.2.2 20 ✓ (1)

3.2.3 1 ✓ (1)

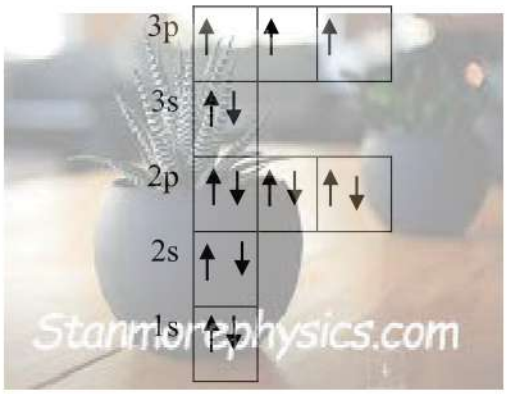
3.2.4 Alkali metals. ✓✓ (2)

3.3 $CaSO_4$ ✓ (2)

3.4 Lead (II) nitrate. ✓✓

Award only 1 mark if answer is: lead nitrate. (2)

3.5



✓ Energy levels 1 and 2

✓ Energy level 3 (2)

[18]

QUESTION 4

4.1.1 E ✓ (1)

4.1.2 B or K ✓ (1)

4.1.3 B or K ✓ (1)

4.1.4 E ✓ (1)

4.1.5 L ✓ (1)

4.1.6 E ✓ (1)

4.2 The energy needed per mole to remove an electron from an atom in the gaseous phase. ✓✓ (2)

4.3 Increases. ✓

Number of protons / atomic number increases from left to right across the period.

Effective nuclear charge increases / the nucleus pulls the outermost orbital much closer to itself. ✓ (3)

More energy is therefore required to remove an electron. ✓

[11]

QUESTION 5

5.1 A mutual attraction between two atoms resulting from the simultaneous attraction between their nuclei and the outer electrons. ✓✓ (2)

5.2.1 Covalent bond. ✓ (1)

5.2.2 Ionic bond. ✓ (1)

5.2.3 Metallic bond. ✓ (1)

5.3 

✓✓ (4)

5.4 A change in which no new substances are formed. ✓✓ (2)

5.5.1 Chemical change. ✓ (1)

5.5.2 $4\ Fe + 3\ O_2 \longrightarrow 2\ Fe_2O_3$

Reactants ✓ Product ✓ Balancing ✓ (3)

5.5.3

LHS	RHS
$4(56) + 3(2 \times 16)$ ✓	$2[2(56) + 3(16)]$ ✓
$= 320$	$= 320$ ✓

LHS = RHS (3)

[18]

QUESTION 6

6.1 The net charge of an isolated system remains constant during any physical process. ✓✓ (2)

6.2 EXCESS✓ (1)

6.31 FROM B TO A. ✓ (1)

6.3.2 $Q = \frac{Q_1+Q_2}{2}$ ✓

$Q = \frac{5\times10^{-9}+(-2\times10^{-2})}{2}$ ✓

$Q = +1.5 \times 10^{-9}C$ ✓ (3)

6.3.3 $n = \frac{Q}{q_e}$ ✓

$n = \frac{+1.5\times10^{-9}}{1.6\times10^{-19}}$✓

$n = 9.375 \times 10^{9}\ electrons$ ✓ (3)

6.4.1 When the charged plastic ruler is brought closer to the uncharged pieces of paper, the paper is polarised✓. The negative charges on the paper are repelled by the negative charges on the ruler. This leaves the side of the paper closest to the ruler positive. ✓ (2)

[12]

QUESTION 7

7.1 Potential difference across the ends of a conductor is the energy transferred per unit electric charge flowing through it. ✓✓ (2)

7.2.1 $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓

$\frac{1}{R_p} = \frac{1}{3} + \frac{1}{6}$ ✓

$R_p = 2\ \Omega$

$R_T = 2+4$✓

$= 6\Omega$✓ (4)

7.2.2 $V_2 = IR$✓

$= (2)(4)$ ✓

$= 8$ V✓ (3)

7.3. NO SOLUTION

[9]

TOTAL 97