ALEXANDER ROAD HIGH SCHOOL

OCTOBER 2020 60 MIN

PHYSICAL SCIENCES CONTROL TEST (green)

CO, JA, MH TOTAL = 60

GRADE 11

Instructions

- The question paper consists of 5 questions.
- Answer all the questions.
- Answer section A on the answer sheet provided AND section B on folio sheets.
- A non-programmable calculator may be used.
- Number the answers correctly according to the numbering system.
- Round off to two (2) decimal places where necessary.
- A formula sheet and table of standard reduction potentials have been provided at the end of the question paper.
- A periodic table has been provided on the back of the answer sheet.

SECTION A

- Answer on the answer sheet -

QUESTION 1: Multiple choice

Four possible options are provided as answers to the following questions. Each question has only 1 correct answer. Choose the correct answer and write the letter (A – D) next to the relevant question number (1.1 – 1.5) on the answer sheet.

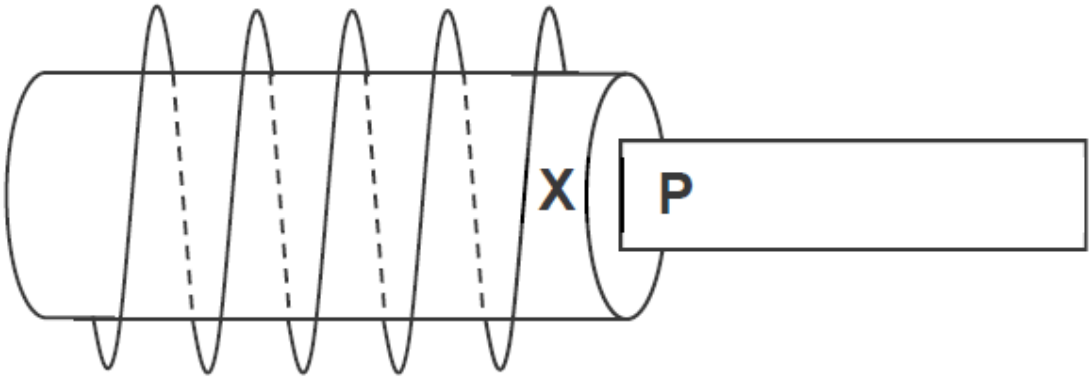
1.1 A gas enclosed in a 2,5 dm^3 syringe has a pressure of 150 kPa. In order to change the pressure of the gas to 230 kPa, the **change in the volume** needs to be…

A. +1,63 dm^3
B. +3,83 dm^3
C. -0,87 dm^3
D. +0,87 dm^3

1.2 Which ONE of the following indicates the CORRECT colour of methyl orange in an acid and a base?

	Methyl Orange in an acid	**Methyl Orange in a base**
A	red	yellow
B	blue	red
C	pink	colourless
D	yellow	blue

1.3 The diagram below shows a coil and a magnet with a pole P. A magnetic field is induced in the coil due to the motion of the magnet.

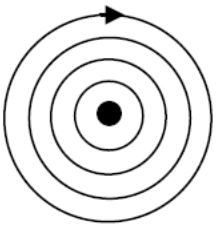


Which ONE of the following combinations will result in an induced magnetic field with a SOUTH POLE at point X?

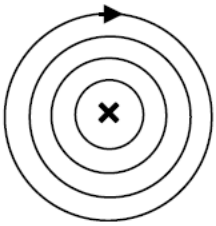
	Direction of Motion of Magnet	**Polarity of P**
A.	Out of the coil	South
B.	Into the coil	South
C.	Into the coil	North
D.	Up and down inside the coil	South

1.4 Which ONE of the sketches below represents the CORRECT magnetic field pattern around a straight current-carrying conductor?

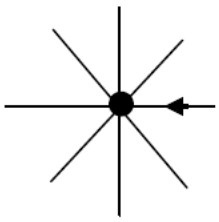
A



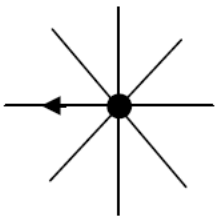
B



C

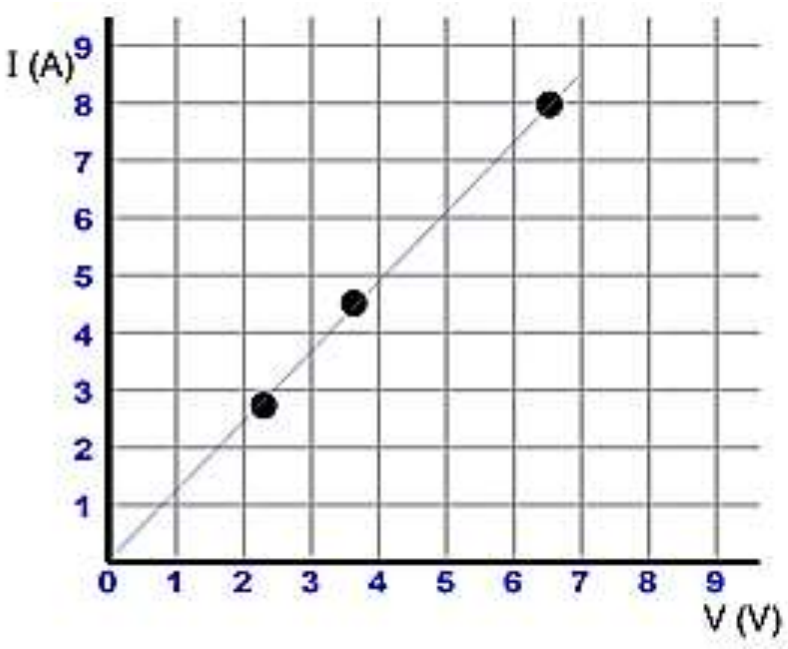


D



1.5 Gr. 11 learners performed an investigation after they heard about Ohm's law. The following set of data was obtained from a circuit with no internal resistance in the battery, and the resistance of the conductors can also be ignored. A voltmeter is connected across a resistor. The following readings were obtained from the voltmeter and ammeter in the circuit

V	I
2.4	2.88
3.6	4.32
6.6	7.92



Which combination of detail is **NOT** correct?

A The dependent variable is current strength, and the gradient is R^{-1}.

B The gradient is R and the independent variable is changed by using more cells .

C The resistor is ohmic and the line of best fit intersects the origin

D The temperature remains constant for this investigation, and the gradient is $^{1}/_{R}$.

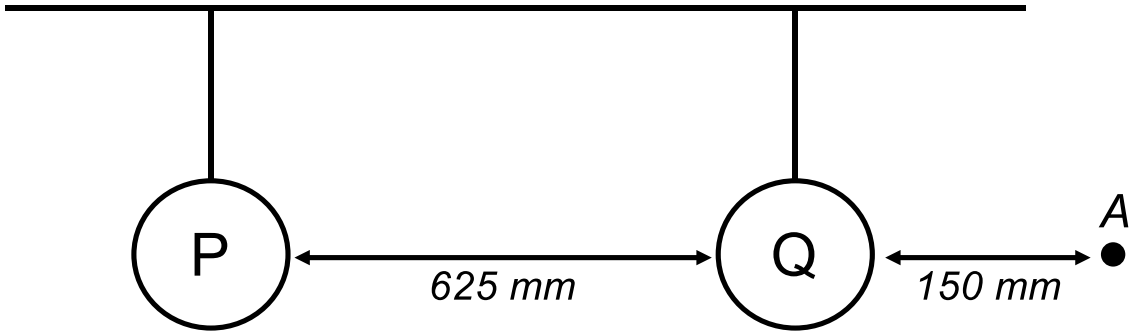
TOTAL SECTION A [10]

SECTION B

-Answer on folio paper-

QUESTION 2:

Two charges, P and Q, with charges -12 nC and 3 nC respectively are placed 625 mm apart. A is a point 150 mm to the right of Q.



2.1 State *Coulomb's law* in words. (2)

2.2 Calculate the magnitude of the electrostatic force between P and Q. (2)

2.3 Use electric field lines to represent the electric field between P and Q. (2)

2.4 Calculate the net electric field strength at A. (5)

2.5 An electron is placed at A. Calculate the force experienced by the electron. (3)

[14]

QUESTION 3:

Calcium oxide reacts with nitric acid according to the following reaction:

$$CaO\ (aq) + 2\ HNO_3 \rightarrow \text{salt X}\ (aq) + H_2O\ (l)$$

3.1 Explain why HNO_3 is regards as an acid according to the Arrhenius definition. (2)

3.2 Write the chemical formula for salt X. (1)

3.3 Name the ampholyte that appears in the formula. (1)

3.4 Write down the **formula** of the TWO conjugate bases that appear in the reaction. (2)

[6]

QUESTION 4:

The reaction between chromate-ions ($Cr_2O_7^{2-}$) and sulphur dioxide (SO_2) is given below.

$$Cr_2O_7^{2-} + SO_2 \rightarrow Cr^{3+} + SO_4^{2-}$$

4.1 Define oxidation in terms of oxidation numbers. (2)

4.2 Balance the equation in an **alkaline** medium. Show the half reactions. (5)

4.3 Write down the formula for the oxidising agent in the reaction. (1)

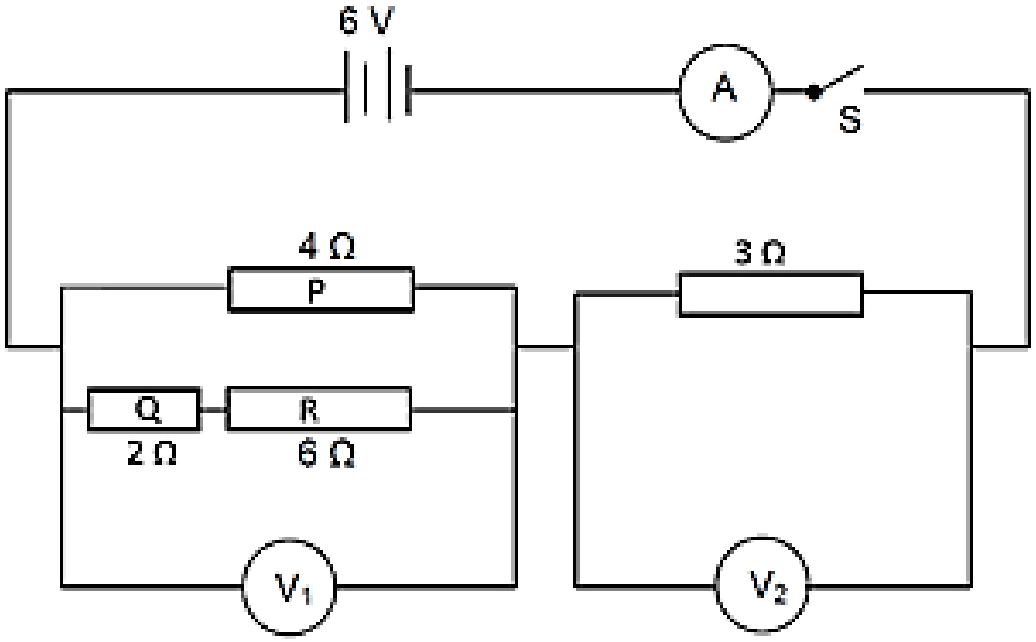
[8]

QUESTION 5:

5.1 State Ohm's law in words. (2)

5.2 Define current strength. (2)

5.3 The circuit below has a cell with voltage 6 V as well as series and parallel resistors, connected as shown below. Voltmeters V_1 and V_2 are connected as shown.



5.3.1 Calculate the total resistance of the parallel connection in the circuit. (3)

5.3.2 Calculate the reading on A if voltmeter V_2 has a reading of 3,17 V. (3)

5.3.3 Calculate the current strength through the 2 Ω resistor (Q). (3)

5.3.4 If the 3 Ω resistor is replaced with a 5 Ω resistor, how will the reading on voltmeter V_1 change? Only write INCREASE, DECREASE or STAY THE SAME? (1)

5.3.5 Explain your answer to 5.3.4. (2)

5.3.6 If **all** the resistors in the parallel connection get replaced with 3 identical 5 Ω bulbs, how will the brightness of the bulbs compare? Refer to bulb P, Q, R. (no calculations needed) (2)

5.4 A **Q** kW geyser is connected in a 16 A circuit. The geyser is switched on for 2 hours and 20 minutes every day and the cost of using the geyser during a 30 day month is R367,50. Calculate **Q** if the unit price of the electricity is R2,10. (4)

[22]

TOTAL SECTION B [50]

TOTAL [60]

Physical Constants

Name	Symbol	Value
Coulomb's constant	k	$9{,}0 \times 10^{9}\ \text{N.m}^2\text{.C}^{-2}$
Charge on electron	e	$-1{,}6 \times 10^{-19}\ \text{C}$
Electron mass	m_e	$9{,}11 \times 10^{-31}\ \text{kg}$

Formula Sheet

ELECTROSTATICS

$F = \frac{kQ_1Q_2}{r^2}$	$E = \frac{F}{q}$
$E = \frac{kQ}{r^2}$	$n = \frac{Q}{e}$

ELECTRIC CIRCUITS

$I = \frac{Q}{\Delta t}$	$R = \frac{V}{I}$
$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} + \cdots$	$R = r_1 + r_2 + r_3 + \cdots$

$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P = \frac{V^2}{R}$