ALEXANDER ROAD HIGH SCHOOL

OCTOBER 2020 60 MIN

PHYSICAL SCIENCES CONTROL TEST (blue)

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.

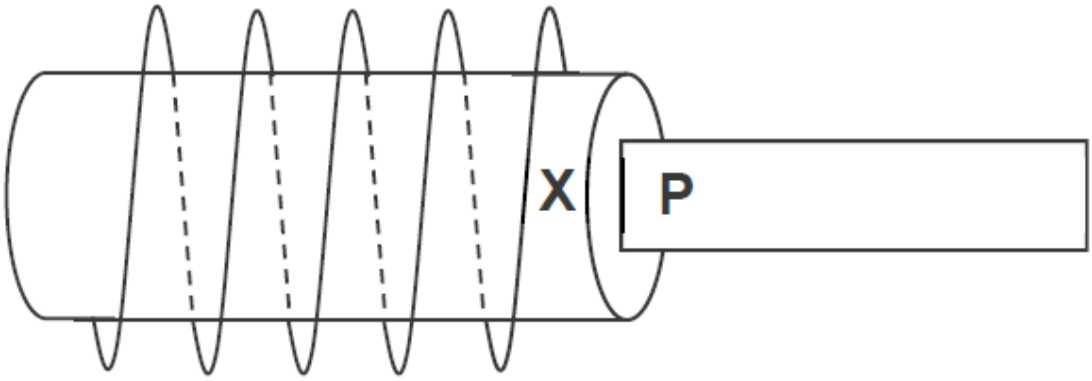
1.1 A gas enclosed in a 1,5 dm^3 syringe has a pressure of 150 kPa. In order to change the pressure of the gas to 125 kPa, the **change in the volume** needs to be…

A. +1,8 dm^3
B. +1,25 dm^3
C. -0,3 dm^3
D. +0,3 dm^3

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

	Bromothymol Blue in an acid	**Bromothymol Blue in a base**
A	orange	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.

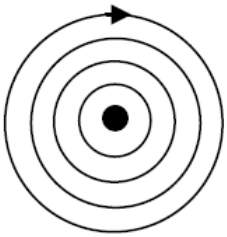


Which ONE of the following combinations will result in an induced magnetic field with a SOUTH POLE at point X?

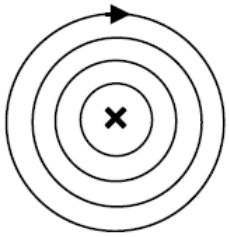
	Direction of Motion of Magnet	**Polarity of P**
A.	Out of the coil	North
B.	Out of the coil	South
C.	Into the coil	North
D.	No motion	South

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

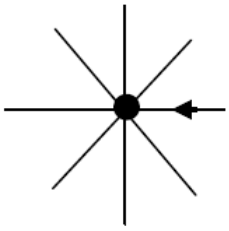
A



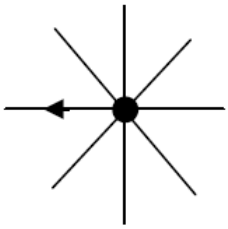
B



C

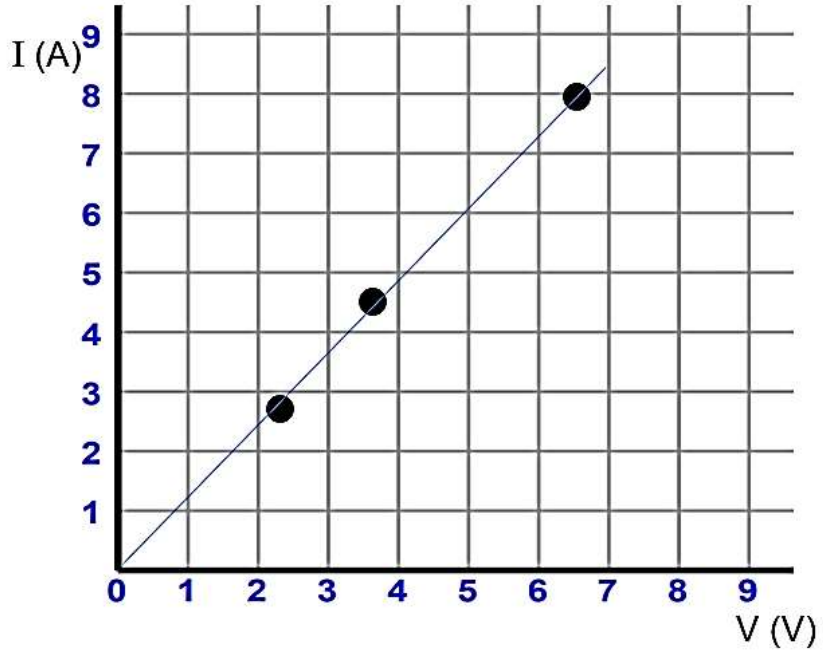


D



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 **incorrect**?

A. The dependent variable is current strength, and the gradient is R^{-1}.
B. The resistor is ohmic and the line of best fit intersects the origin.
C. The gradient is R and the independent variable is changed by adding more cells.
D. The temperature remains constant for this investigation, and the gradient is $^{1}/_{R}$.

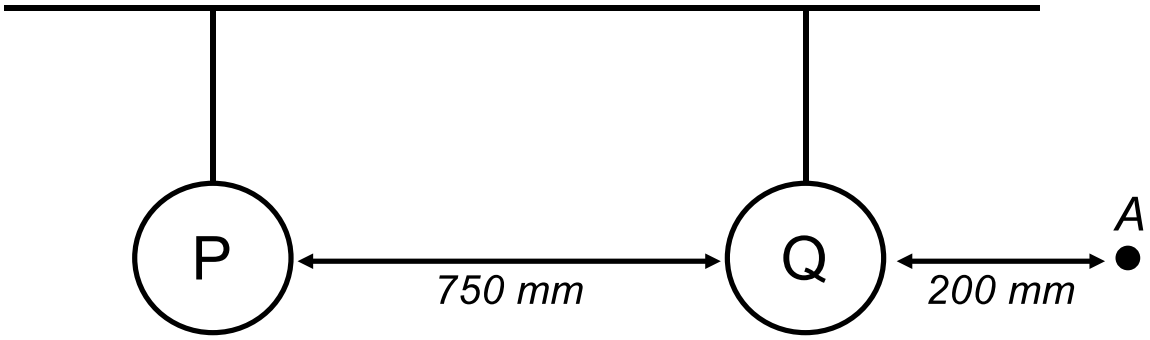
TOTAL SECTION A [10]

SECTION B

-Answer on folio paper-

QUESTION 2:

Two charges, P and Q, with charges 15 nC and 2 nC respectively are placed 750 mm apart. A is a point 200 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 A proton is placed at A. Calculate the force experienced by the proton. (3)

[14]

QUESTION 3:

Sulfuric acid reacts with sodium hydroxide according to the following reaction:

$$H_2SO_4\,(aq) + 2\,NaOH\,(aq) \rightarrow \text{salt X}\,(aq) + 2\,H_2O\,(l)$$

3.1 Explain why the OH^--ion in NaOH is regarded as a base according to the Lowry-Brønsted 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 acids that appear in the reaction. (2)

[6]

QUESTION 4:

The reaction between permanganate ions (MnO_4^-) and sulphur dioxide (SO_2) is given below.

$$SO_2 + MnO_4^- \rightarrow SO_4^{2-} + Mn^{2+}$$

4.1 Define reduction 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 reducing agent in the reaction. (1)

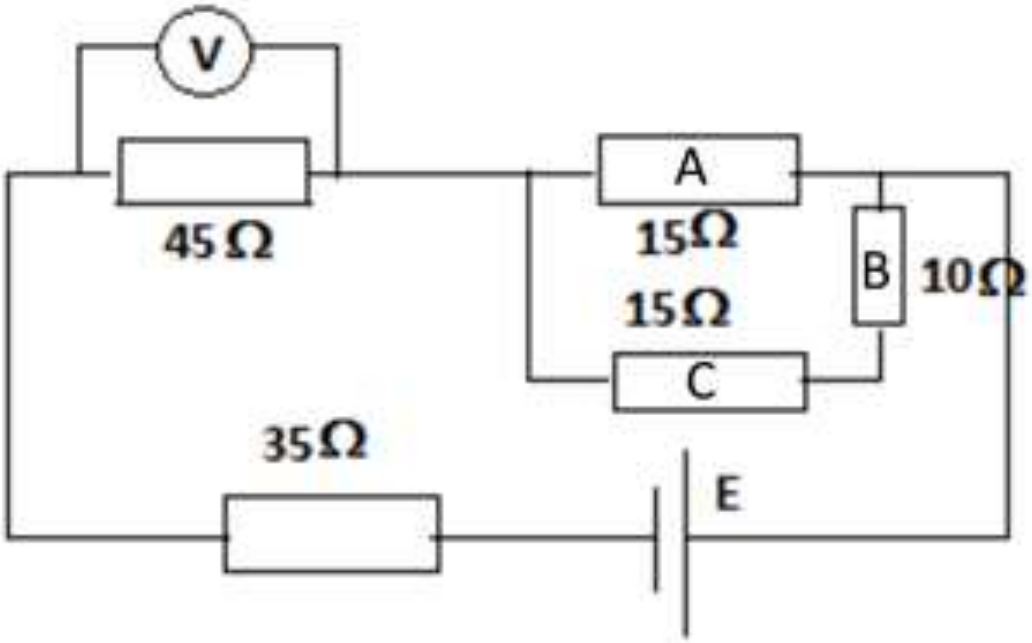
[8]

QUESTION 5:

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

5.2 Define *potential difference*. (2)

5.3 The circuit below has a cell with voltage E as well as series and parallel resistors, connected as shown below. A voltmeter is connected across the 45Ω resistor.



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

5.3.2 Calculate the total current in the circuit if the voltmeter reading is 50 V. (3)

5.3.3 Calculate the current strength through the 10 Ω resistor (B). (3)

5.3.4 If the 35Ω resistor is replaced with a 5Ω resistor, how will the voltmeter reading change? Only write INCREASE, DECREASE or STAY THE SAME? (1)

5.3.5 Explain you answer to 5.3.4. (2)

5.3.6 If **all** the resistors in the parallel connection get replaced with 3 identical 8Ω bulbs, how will the brightness of the bulbs compare? Refer to bulb A, B, C. (no calculations needed) (2)

5.4 A 2kW kettle is connected in a 16A circuit. The kettle is used for 18 minutes every day and the cost of using the kettle during a 31-day month is R38,13. Calculate the unit price of the electricity. (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

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