education

Department of Education
FREE STATE PROVINCE

CONTROL TEST

GRADE 11

PHYSICAL SCIENCES

SEPTEMBER 2018

MARKS: 100

TIME: 2 HOURS

This paper consists of 10 pages and THREE information sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name and other information in the appropriate spaces on the ANSWER BOOK.

2. This question paper consists of 7 questions. Answer ALL questions in the ANSWER BOOK.

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. Leave one line between two sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.

6. You may use a non-programmable pocket 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 where applicable.

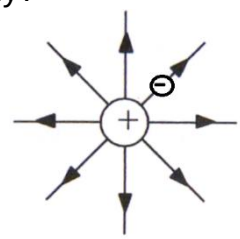
11. Give brief motivations, discussions, et cetera where required.

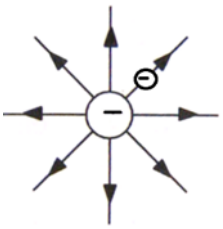
12. Write neatly and legibly.

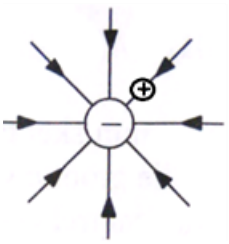
QUESTION 1

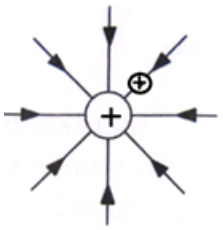
Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write down only the letter A, B, C or D next to the question number (1.1-1.10) in your ANSWER BOOK.

1.1 Which one of the following diagrams indicates the direction of magnetic fields and how it is determined with a test charge around charged spheres correctly?

A 

B 

C 

D 

(2)

1.2 Two charged objects with a charge of **-Q** and **+Q** attract each other with a force **F** when they are separated by a distance d. The objects touch each other and the distance between the charges is increased to 3d. The new force, in terms of **F**, will now be ….

A 0

B $\frac{1}{9}$ F

C $\frac{1}{3}$ F

D F

(2)

1.3 Which ONE of the following will be calculating the power of a resistor?

A $\frac{\text{Watt}}{\text{second}}$

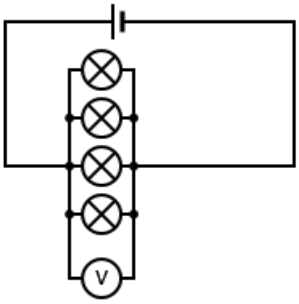
B $\frac{\text{Joule}}{\text{second}}$

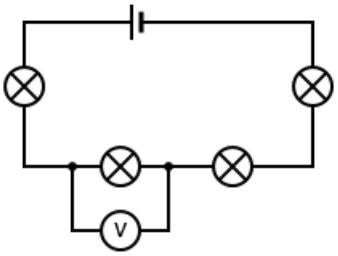
C $\frac{\text{Coulomb}}{\text{second}}$

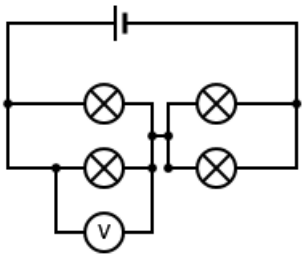
D $\frac{\text{Volt}}{\text{second}}$

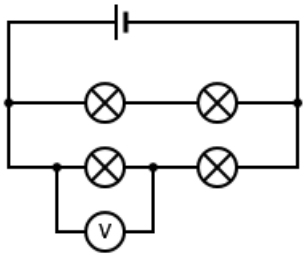
(2)

1.4 A set of identical light bulbs are connected as shown in the circuit diagrams below. The internal resistance of the battery is negligible. A single voltmeter is connected over any ONE lightbulb in each circuit.
In which circuits will the Voltmeter have the highest value?

A 

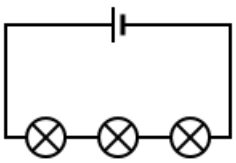
B 

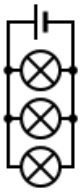
C 

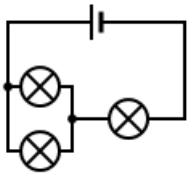
D 

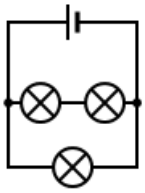
(2)

1.5 A learner has THREE 6Ω resistors. He uses all three and determine that the total resistance is 9Ω. Which circuit represent the correct connection of the resistors?

A 

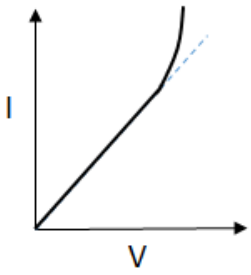
B 

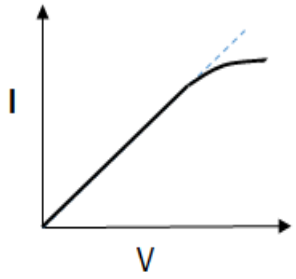
C 

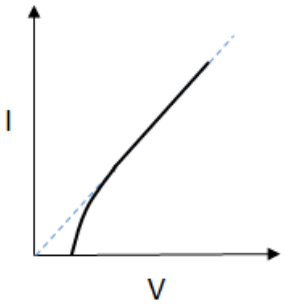
D 

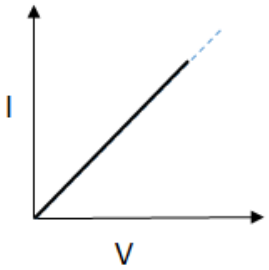
(2)

1.6 Ohm's law was investigated using a filament light bulb. The correct graph of the current through it versus the potential difference over it is:

A


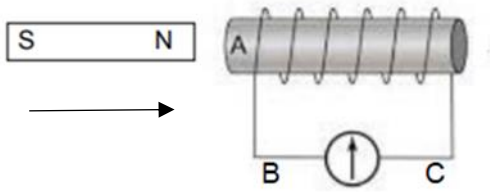
B


C


D


(2)

1.7 In the diagram below, the north pole of a bar magnet approaches end **A** of a solenoid.



Which ONE of the following statements about the polarity of **A** and the direction of the induced current direction is CORRECT as the NORTH POLE moves towards **A**?

	Polarity of A	**Current direction**
A	North	B to C
B	South	C to B
C	North	C to B
D	South	B to C

The question was not clear about the path of BC or CB; through the coil or through the G-meter? Hence, A and C should be accepted for an answer.

(2)

1.8 The empirical ratio for N:O:H was found as 1:1:5. A possible molecular formula can be:

A $(NO)_5H$

B NH_4OH

C $_5NOH$

D $(NOH)_5$

(2)

1.9 A chemical reaction is found to have a percentage yield of 50%. This means that the actual yield is …

A half the percent yield
B half the theoretical yield
C twice the theoretical yield
D equal to theoretical yield (2)

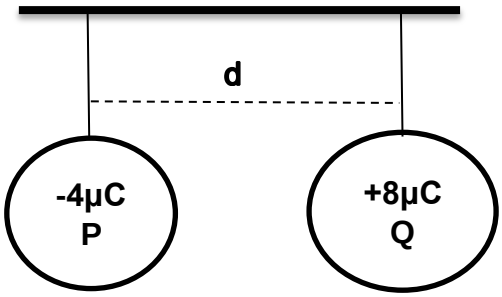
10 Two identical containers are filled with different gases at the same temperature and pressure. The one contains ozone gas (O_3) and the other an unknown gas **X**. The mass of the ozone gas in the bottle is 0,48 g and the mass of gas **X** is 0,34 g. Gas **X** is:

A O_2
B SO_2
C NH_3
D H_2S (2)

[20]

QUESTION 2

2.1 Two identical metal spheres, **P** and **Q**, separated by a distance d, are suspended from an insulated rigid wooden bar, as shown in the diagram below. The charge on the spheres are -4 µC and +8 µC respectively.



2.1.1 Sphere **Q** experiences an electrostatic force. Write down Coulombs Law in words. (2)

2.1.2 In which direction will sphere **Q** move? Write down only TO THE LEFT or TO THE RIGHT. (1)

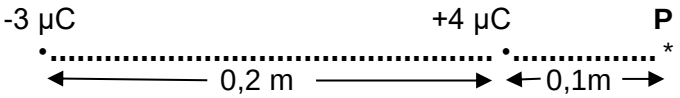
The spheres are now made to touch and are then separated.

2.1.3 Were electrons REMOVED FROM or TRANSFERRED to P? (1)

2.1.4 Calculate the new charge of the two spheres. (2)

2.1.3 Calculate the distance **d** between the two spheres if the magnitude of the force experienced by P is 1,6 N. (4)

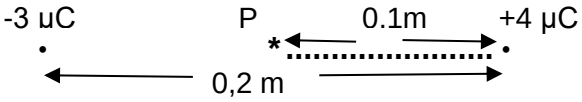
2.2 Charges of +4 µC and -3 µC are placed a distance 0,2 m apart on a straight line, as shown below. Point **P** is located 0,1 m to the right of the +4 µC charge.



Calculate the:

2.2.1 Net electric field at point **P**. (6)

Point **P** is now moved to 0,1 m to the left of the +4 µC charge on the same straight line.

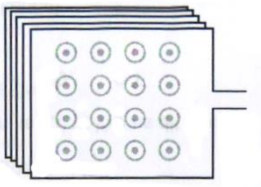


2.2.2 How will the magnitude of the electric field produced by the +4 µC charge at the new point **P** compare to the electric field produced by the +4 µC charge where point **P** previously was? Write down only INCREASE, DECREASE or REMAIN THE SAME. (1)

2.2.3 Explain your answer in question 2.2.2. (2)
[19]

QUESTION 3

3.1 A flat square wire coil, of which the length of each side is 20 cm, containing 5 windings is placed in a constant magnetic field of 0.3 T. The plane of the coil is perpendicular to the magnetic field. The field is aligned with the paper as indicated in the diagram.



3.1.1 Write Faraday's law. (2)

3.1.2 Is there an induced current in the coil? Give a reason for your answer. (2)

The magnetic field is increased uniformly from 0.3T to 0.8T in 1 s.

3.1.3 Calculate the induced emf in the coil while this change takes place. (5)

As the magnetic field changes, the induced emf causes a flow of current in the coil.

3.1.4 Does the current flow clockwise or anti-clockwise in the coil? (1)

3.1.5 If the coil has a resistance of 50 Ω, calculate the magnitude of the induced current. (3)

3.2 What will the effect of the following changes be on the induced EMF as calculated in question 3.1.2? Write only HALVE, DOUBLE or NO CHANGE.

3.2.1 The number of coils is doubled. (1)

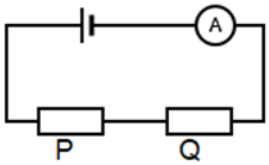
3.2.2 The magnetic field is changed in half the time. (1)

3.3 Name ONE change that can be made to the coil to increase the magnetic flux. (1)

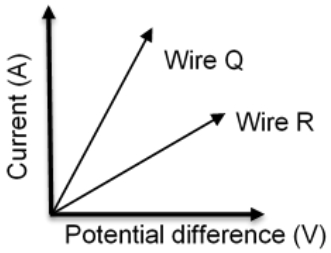
[16]

QUESTION 4

4.1 Learners investigate the conducting ability of two metal wires **P** and **Q**, made of the same material. They connect BOTH wires in a circuit as shown below.



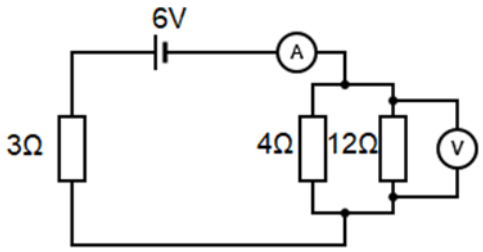
The potential difference across the wires are increased and measured. The resulting current through these wires is measured. Using the measurements, the learners obtained the following sketch graphs for each of the wires.



4.1.1 Name ONE possible physical difference between the two wires. (1)

4.1.2 Which one (**P** or **Q**) is the better conductor? Explain your answer (3)

4.2 In the following circuit diagram the internal resistance of the ammeter and the 6V battery is negligible. The voltmeter has a very high resistance.



4.2.1 Calculate the equivalent resistance of the parallel network. (3)

4.2.2 Calculate the reading on the ammeter. (3)

4.2.3 Calculate the reading on the voltmeter. (2)

4.2.4 Calculate the current in the 4 Ω resistor. (2)

4.2.5 In which one of the 4 Ω or 12 Ω resistors is the most energy per second transferred? Explain briefly. (3)

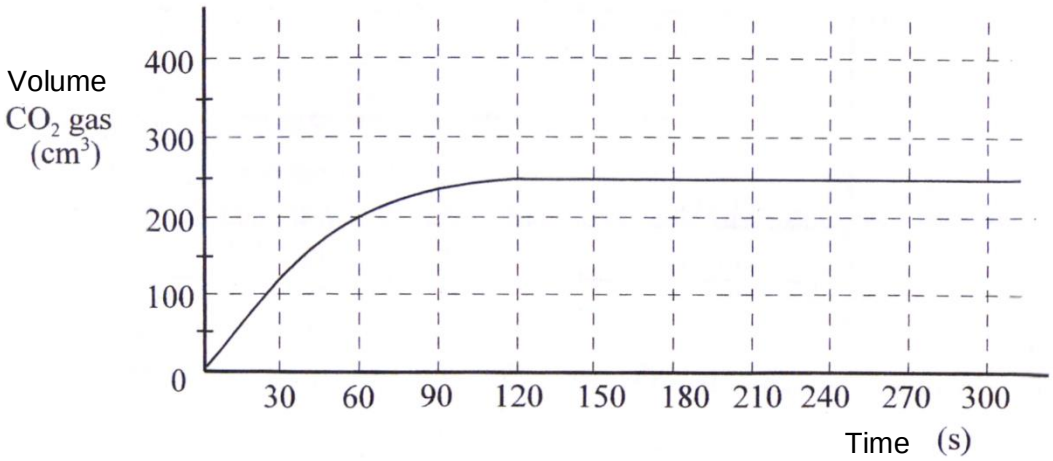
[17]

QUESTION 5

5.1 A learner adds an excess of hydrochloric acid solution to $CaCO_3$ grains. The concentration of the hydrochloric acid solution is 0,1 $mol.dm^{-3}$ and the volume added is 500 cm^3. The reaction that takes place is represented by the following equation:

$$2HCl(aq) + CaCO_3(s) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

The CO_2 gas formed fills a large gas syringe. The volume of gas collected is measured every 30 s. The results are shown on the graph below.



5.1.1 How long did it take for the reaction to be completed? (1)

5.1.2 Determine the volume of CO_2 gas that formed. (1)

5.1.3 Which substance is the limiting reagent? (1)

5.1.4 Calculate the mass $CaCO_3$ grains used in the experiment. The CO_2 gas collected in the syringe is at a temperature of 25 ° C and is at standard pressure. (7)
[10]

QUESTION 6

A nitrogen and oxygen composition of 4,6 g contains 3,2 g of oxygen.

6.1 Calculate the empirical formula of the compound. (4)

6.2 If it is known that 46 g of the gas at STD occupies 11,2 dm^3, calculate the molecular formula of the compound. (4)
[8]

QUESTION 7

In an experiment a 40,88 g sample of impure zinc reacted with hydrochloric acid:

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

It was found that 68 g of $ZnCl_2$ formed.

7.1 Calculate the number of moles of $ZnCl_2$ that formed. (3)

7.2 Calculate the percentage of purity of the sample. (4)

7.3 Calculate the concentration of the HCl if 0,2 dm^3 HCl has reacted with the Zn. (3)
[10]

Total 100

DATA FOR PHYSICAL SCIENCES GRADE 11 (PHYSICS)
CONTROL TEST - TERM 3

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11 (FISIKA)
KONTROLETOETS - KWARTAAL 3

TABLE 1: PHYSICAL CONSTANTS / *TABEL 1: FISIESE KONSTANTES*

NAME / *NAAM*	SYMBOL / *SIMBOOL*	VALUE / *WAARDE*
Coulomb's constant *Coulomb se konstante*	k	$9,0 \times 10^{9}\ N{\cdot}m^{2}{\cdot}C^{-2}$
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}\ kg$

TABLE 2: FORMULAE / *TABEL 2: FORMULES*

ELECTROSTATICS / *ELEKTROSTATIKA*

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

ELECTROMAGNETISM / *ELEKTROMAGNETISME*

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

CURRENT ELECTRICITY / *STROOMELEKTRISITEIT*

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

DATA FOR PHYSICAL SCIENCES GRADE 11 (CHEMISTRY)
CONTROL TEST - TERM 3

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11 (CHEMISTRY)
KONTROLETOETS - KWARTAAL 3

TABLE 1: PHYSICAL CONSTANTS / *TABEL 1: FISIESE KONSTANTES*

NAME / *NAAM*	SYMBOL / *SIMBOOL*	VALUE / *WAARDE*
Avogadro's constant *Avogadrokonstante*	N_A	$6{,}02 \times 10^{23}\ mol^{-1}$
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	$22{,}4\ dm^3 \cdot mol^{-1}$
Standard pressure *Standaarddruk*	p^θ	$1{,}013 \times 10^5\ Pa$
Standard temperature *Standaardtemperatuur*	T^θ	273 K
Charge on electron *Lading op elektron*	e	$-1{,}6 \times 10^{-19}\ C$
Molar gas constant *Molêre gaskonstante*	R	$8{,}31\ J \cdot K^{-1} \cdot mol^{-1}$

TABLE 2: FORMULAE / *TABEL 2: FORMULES*

$\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$	$pV = nRT$
$n = \frac{m}{M}$	$c = \frac{n}{V}$
$c = \frac{m}{MV}$	$\frac{n_a}{n_b} = \frac{c_aV_a}{c_bV_b}$ / $\frac{n_s}{n_b} = \frac{c_sV_s}{c_bV_b}$

THE PERIODIC TABLE OF ELEMENTS
DIE PERIODIEKE TABEL VAN ELEMENTE