education

Department of Education
FREE STATE PROVINCE

GRADE 11
PROVINCIAL FORMAL ASSESSMENT TASK

SEPTEMBER 2015

PHYSICAL SCIENCES
CONTROL TEST 2

TIME: 2 HOURS

MARKS: 100

This paper consists of TEN pages and THREE information sheets.

INSTRUCTIONS AND INFORMATION

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

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

3. Start EACH question on a NEW page.

4. Number the answers correctly according to the numbering system used in this question paper.

5. Leave ONE line between two subquestions, for example between QUESTION 3.1 and QUESTION 3.2.

6. You may use a non-programmable pocket calculator.

7. You may use appropriate mathematical instruments.

8. You are advised to use the DATA SHEETS attached.

9. Show ALL formulae and substitutions in ALL calculations.

10. Round off your final numerical answers to a minimum of TWO decimal places.

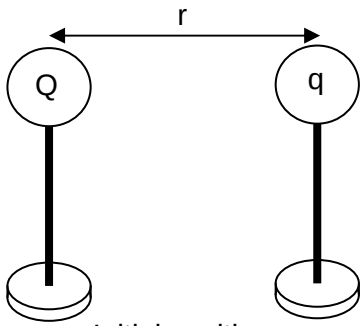
11. Give brief motivations, discussions, et cetera where required.

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 only the letter (A–D) next to the question number (1.1–1.10) in your ANSWER BOOK.

1.1 Two small, identical metal spheres, on insulated stands, carry charges of *Q* and *q*, as indicated in the diagram below. When their centres are at a distance *r* from each other, one sphere experiences an electrostatic force *F* due to the presence of the other sphere.



Initial position

If the distance between the centres of the spheres is now halved, the magnitude of the new electrostatic force will be ...

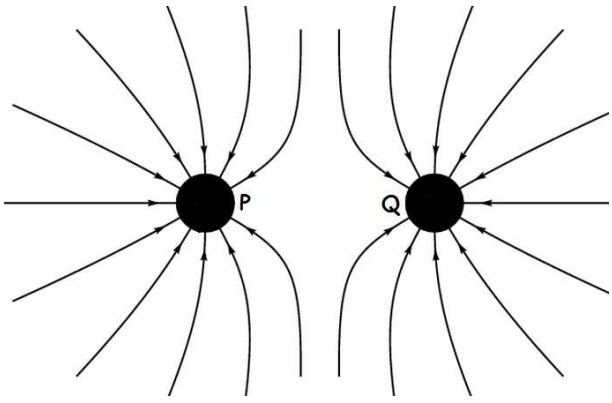
A ¼F.

B ½F.

C 2F.

D 4F. (2)

1.2 Consider the following electric field pattern due to two point charges **P** and **Q**.

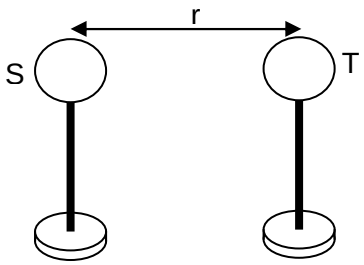


Which ONE of the following correctly represents the type of charge on each of **P** and **Q**?

	P	**Q**
A	Negative	Negative
B	Negative	Positive
C	Positive	Positive
D	Positive	Negative

(2)

1.3 Two small metal spheres, **S** and **T**, on insulated stands, carry charges *Q* and *q* respectively and their centres are a distance *r* apart.

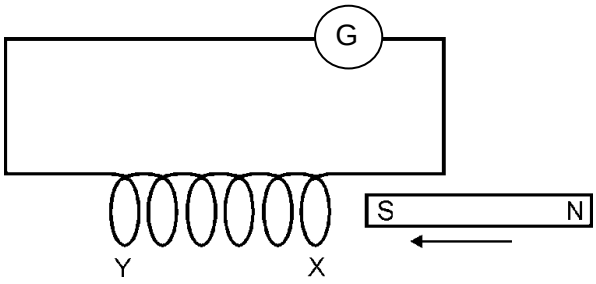


Which ONE of the following formulae could be used to calculate the magnitude of the electric field strength of sphere **T** at the position of sphere **S**?

A	$E = \frac{W}{qr}$
B	$E = \frac{F}{q}$
C	$E = \frac{kq}{r^2}$
D	$E = \frac{kQ}{r^2}$

(2)

1.4 The south pole of a bar magnet is pushed into end **X** of a solenoid. The needle of the middle-zero galvanometer, connected to the solenoid, shows a deflection to the left.



Which ONE of the following actions will produce the same deflection of the needle of the galvanometer?

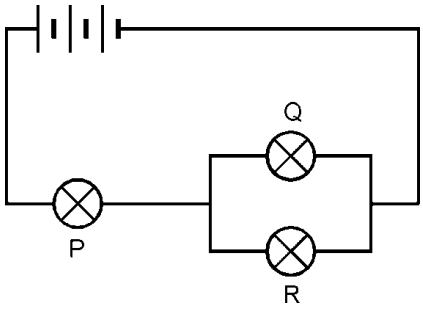
A Push the north pole of the magnet into end **X** of the solenoid.

B Pull the north pole of the magnet out of end **X** of the solenoid.

C Pull the north pole of the magnet out of end **Y** of the solenoid.

D Push the south pole of the magnet into end **Y** of the solenoid. (2)

1.5 Consider the circuit represented by the circuit diagram below. The internal resistance of the battery may be ignored.

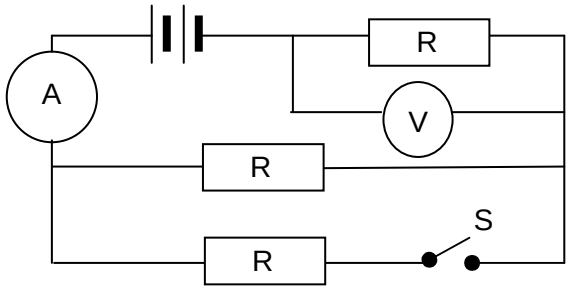


The filament of bulb **R** breaks. Which ONE of the following correctly shows the CHANGE IN POTENTIAL DIFFERENCE across bulbs **P** and **Q**?

	Bulb P	**Bulb Q**
A	Increase	Decrease
B	No effect	Increase
C	Decrease	Increase
D	Decrease	Decrease

(2)

1.6 In the circuit diagram represented below, three identical resistors are connected as shown. The battery, ammeter **A** and connecting wires have negligible resistance. The switch **S** in the circuit is open.



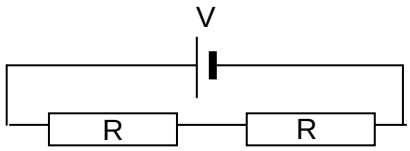
Switch **S** is now closed. Which ONE of the following combinations correctly gives the changes in the readings on the ammeter and voltmeter?

	Ammeter reading	**Voltmeter reading**
A	Increase	Increase
B	Increase	Decrease
C	Decrease	Increase
D	Decrease	Decrease

(2)

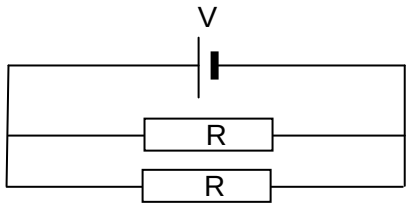
1.7 The two resistors in circuit 1 below are identical. They are connected in series to a cell of emf *V* and negligible internal resistance. The power dissipated by each resistor is *P*.

Circuit 1



The two resistors are now connected in parallel, as shown in circuit 2 below. The same cell is used.

Circuit 2



The power dissipated by each resistor in circuit 2 is …

A 2P.

B 4P.

C 8P.

D 16P. (2)

1.8 One mole of P_4 contains ...

A 1 molecule of P.

B 4 molecules of P.

C $1{,}505 \times 10^{23}$ atoms of P.

D $24{,}08 \times 10^{23}$ atoms of P. (2)

1.9 16 gram of oxygen gas at STP occupies …

A 5,6 dm^3.

B 11,2 dm^3.

C 22,4 dm^3.

D 44,8 dm^3. (2)

1.10 A certain oxide is formed when 0,5 mole of element **X** bond to 0,375 mole of oxygen gas. Which ONE of the following is the correct empirical formula for this oxide?

A XO

B XO_3

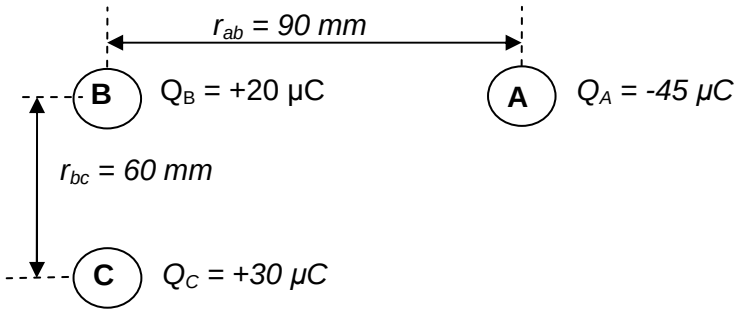
C X_2O

D X_2O_3 (2)

[20]

QUESTION 2

Three CHARGED objects, **A**, **B** and **C** are placed at right angles to each other in a 2 D plane as shown in the diagram below. Object **A** (-45 µC) is 90 mm from object **B** (+20 µC). Object **C** (+30 µC) is 60 mm from object **B**.



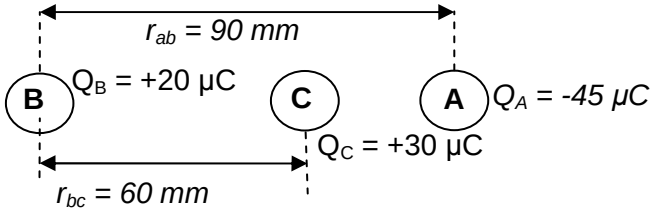
2.1 State Coulomb's Law. (2)

2.2 Draw a free-body diagram, with labels, showing the electrostatic forces experienced by object **B** due to objects **A** and **C**. (2)

2.3 Calculate the electrostatic force exerted on **B** due to the presence of object **A**. (4)

2.4 The magnitude of the electrostatic force exerted on **B** due to the presence of **C** is $1,5 \times 10^3$ N. Calculate the magnitude of the net electrostatic force exerted on **B** due to the presence of **A** AND **C**. (3)

2.5 Object **C** is now placed between **A** and **B** at a distance 60 mm from **B**.



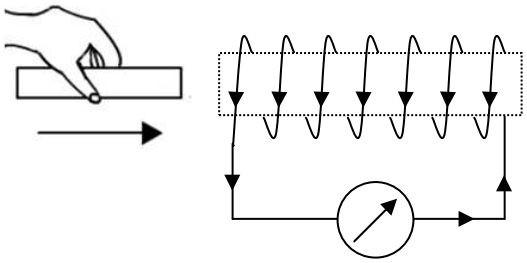
2.5.1 Define electric field strength at a point. (2)

2.5.2 Calculate the net electric field at **C** if the magnitude of the electric field that **C** experiences due to **B**, is equal to 5×10^7 N·C^{-1}. (6)

[19]

QUESTION 3

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



3.1.1 Write down the polarity (north pole or south pole) of the end of the coil facing the bar magnet, as the bar magnet approaches the coil. (2)

3.1.2 Which pole of the bar magnet is approaching the coil? Write down only NORTH POLE or SOUTH POLE. (1)

3.1.3 Write down what will be observed on the galvanometer if the bar magnet is held stationary inside the coil. Give a reason for the answer. (2)

3.2 A coil of wire consists of 20 densely packed loops. Each loop has an area of $1,5 \times 10^{-3}$ m^2. A magnetic field is perpendicular to the surface of each loop. At t = 0 s, the magnitude of the magnetic field in the coil is 0,05 T. At a later time, t = 0,1 s, the magnetic field in the coil is 0,06 T.

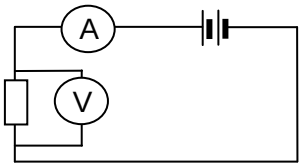
3.2.1 State Faraday's law in words. (2)

3.2.2 Calculate the magnetic flux in each loop at t = 0 s (3)

3.2.3 Calculate the change in magnetic flux in each loop during the 0,1 s (2)
[12]

QUESTION 4

A learner investigates Ohm's law. He sets up the following circuit.



4.1 Represent Ohm's law in symbols. (1)

The learner obtains the following results:

Potential difference (V)	Current (A)
12,0	2,4
9,0	1,8
6,0	1,2
3,0	0,6

4.2 Calculate the resistance of the resistor in the above circuit. (3)

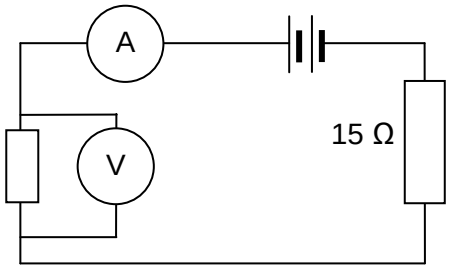
4.3 Is the resistor in the above circuit an OHMIC or a NON-OHMIC resistor? Give a reason for the answer. (2)

4.4 On the same set of axes, sketch graphs of potential difference versus current for an ohmic and a non-ohmic resistor. Clearly label the graph for the ohmic resistor as **P** and the graph for the non-ohmic resistor as **Q**. (2)

4.5 Explain in full why the curve drawn for a non-ohmic resistor differs from that of an ohmic resistor. (3)

4.6 Give an example of a non-ohmic resistor used in our daily lives. (1)

The learner now adds a 15 Ω ohmic resistor to the circuit as shown in the diagram below.

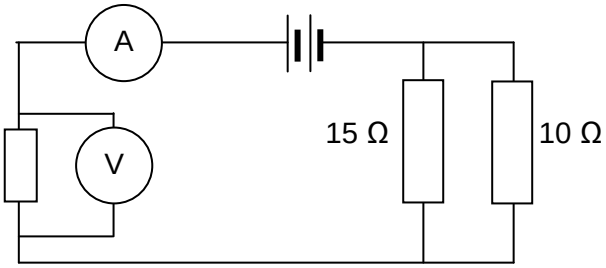


4.7 Calculate the total resistance of the above circuit. (1)

4.8 How will the ammeter reading compare to the reading given in the above table if the learner uses the 6 V cell? Only write down EQUAL TO, GREATER THAN or SMALLER THAN. (1)

4.9 Calculate the potential difference across the 15 Ω resistor if he uses the 6 V cell. (5)

The learner now adds a third resistor with a resistance of 10 Ω to the circuit and replaces the cells with different cells.



4.10 Calculate the total resistance of the above circuit. (4)

4.11 How will the voltmeter reading of a voltmeter connected across the 15 Ω resistor compare to that of a voltmeter connected across the 10 Ω resistor? Only write down EQUAL TO, GREATER THAN or SMALLER THAN. (1)

[24]

QUESTION 5

5.1 Concentrated hydrochloric acid, HCℓ, is used to clean bricks. Its concentration is 11,7 mol·dm^{-3}.

5.1.1 Determine the volume of concentrated acid that is required to prepare 5 litres of a 3,5 mol·dm^{-3} solution of the acid for routine use. (4)

5.1.2 Determine the volume of the original concentrated acid solution which contains 9,57 g of HCℓ. (4)

5.2 10 g of marble (calcium carbonate) reacts with an EXCESS hydrochloric acid solution according to the following balanced chemical equation:

$$CaCO_3(s) + 2HC\ell(aq) \rightarrow CaC\ell_2(aq) + CO_2(g) + H_2O(\ell)$$

Calculate the:

5.2.1 number of moles of $CaCO_3$; (3)

5.2.2 number of moles of CO_2; (2)

5.2.3 mass of the CO_2; and (2)

5.3 percentage yield of carbon dioxide if 3,65 g of the gas is collected when 10 g of the marble reacts? (2)

[17]

QUESTION 6

Vinegar, which is used in our homes, is a dilute form of acetic acid. A sample of acetic acid has the following percentage composition: 39,9% carbon, 6,7% hydrogen and 53,4% oxygen

6.1 Determine the empirical formula of acetic acid. (5)

6.2 Determine the molecular formula of acetic acid if the molar mass of acetic acid is 60 g·mol^{-1}. (3)

[8]

GRAND 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

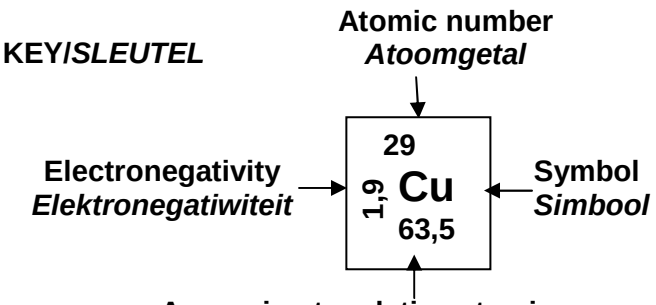
TABLE 1: PHYSICAL CONSTANTS / *TABEL 1: FISIESE KONSTANTES*

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*

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

TABLE 3: THE PERIODIC TABLE OF ELEMENTS
TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE



1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
2,1 1 H 1																	2 He 4
1,0 3 Li 7	1,5 4 Be 9											2,0 5 B 11	2,5 6 C 12	3,0 7 N 14	3,5 8 O 16	4,0 9 F 19	10 Ne 20
0,9 11 Na 23	1,2 12 Mg 24											1,5 13 Aℓ 27	1,8 14 Si 28	2,1 15 P 31	2,5 16 S 32	3,0 17 Cℓ 35,5	18 Ar 40
0,8 19 K 39	1,0 20 Ca 40	1,3 21 Sc 45	1,5 22 Ti 48	1,6 23 V 51	1,6 24 Cr 52	1,5 25 Mn 55	1,8 26 Fe 56	1,8 27 Co 59	1,8 28 Ni 59	1,9 29 Cu 63,5	1,6 30 Zn 65	1,6 31 Ga 70	1,8 32 Ge 73	2,0 33 As 75	2,4 34 Se 79	2,8 35 Br 80	36 Kr 84
0,8 37 Rb 86	1,0 38 Sr 88	1,2 39 Y 89	1,4 40 Zr 91	41 Nb 92	1,8 42 Mo 96	1,9 43 Tc	2,2 44 Ru 101	2,2 45 Rh 103	2,2 46 Pd 106	1,9 47 Ag 108	1,7 48 Cd 112	1,7 49 In 115	1,8 50 Sn 119	1,9 51 Sb 122	2,1 52 Te 128	2,5 53 I 127	54 Xe 131
0,7 55 Cs 133	0,9 56 Ba 137	57 La 139	1,6 72 Hf 179	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	1,8 81 Tℓ 204	1,8 82 Pb 207	1,9 83 Bi 209	2,0 84 Po	2,5 85 At	86 Rn
0,7 87 Fr	0,9 88 Ra 226	89 Ac															

58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr