education
Department:
Education
PROVINCE OF KWAZULU-NATAL

ENQUIRIES: MRS E. COETZEE	NO: 031 - 327 0462	DATE: 19/09/2016

ERRATA/ERRATUM

COMMON TEST SEPTEMBER 2016

GRADE 11

SUBJECT: PHYSICAL SCIENCE P1

DATE: 23 SEPTEMBER 2016

ATTENTION: CHIEF INVIGILATOR

PAGE	QUESTION	ERROR	CORRECTION
6	4	A current of 2 A registers on ammeter A_1.	A current of 0,8 A registers on ammeter A_1.

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19. 09. 2016
DATE

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Education

KwaZulu-Natal Department of Education

REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES P1 (PHYSICS)

COMMON TEST

SEPTEMBER 2016

NATIONAL SENIOR CERTIFICATE

GRADE 11

MARKS: 50

TIME: 1 hour

This question paper consists of 6 pages and 2 data sheets.

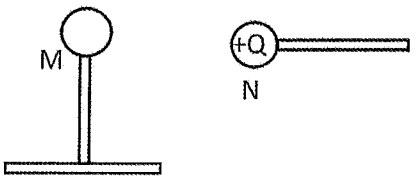
INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate space on the ANSWER BOOK.
2. This question paper consists of 4 questions. Answer ALL the questions in the ANSWER BOOK.
3. You may use a non-programmable calculator.
4. You may use appropriate mathematical instruments.
5. YOU ARE ADVISED TO USE THE ATTACHED DATA SHEETS.
6. Number the answers correctly according to the numbering system used in this question paper.
7. Write neatly and legibly.

QUESTION 1

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 number (1.1–1.3) in the ANSWER BOOK, for example 1.3 D.

1.1 A neutral metal sphere, M, is placed on an insulated stand. An identical metal sphere, N, carries a charge of +Q as shown.



M and N are now brought into contact. What is the magnitude of the charge on M when N moves away?

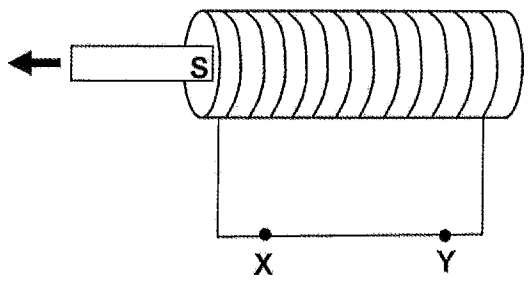
A Q

B $\sqrt{Q}$

C $\frac{Q}{2}$

D 0 (2)

1.2 A bar magnet is moved out of a coil, as shown in the diagram below. **X** and **Y** are two points on the conductor.



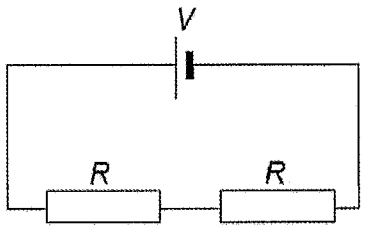
Which ONE of the following CORRECTLY describes the direction of the current and the polarity of the left end of the coil?

	DIRECTION OF CURRENT	POLARITY OF LEFT END OF COIL
A	X to Y	north
B	X to Y	south
C	Y to X	north
D	Y to X	south

(2)

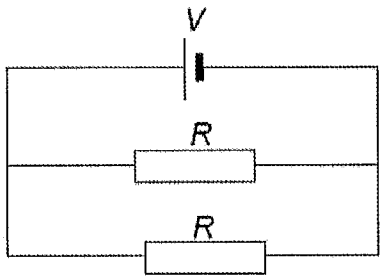
1.3 The two resistors in circuit 1 below are identical. They are connected in series to a cell of emf *V* and negligible internal resistance. The power dissipated by each resistor is *P*.

Circuit 1



The two resistors are now connected in parallel, as shown in circuit 2 below.

Circuit 2



The power dissipated by each resistor in the circuit 2 is ...

A 2P.

B 4P.

C 8P.

D P.

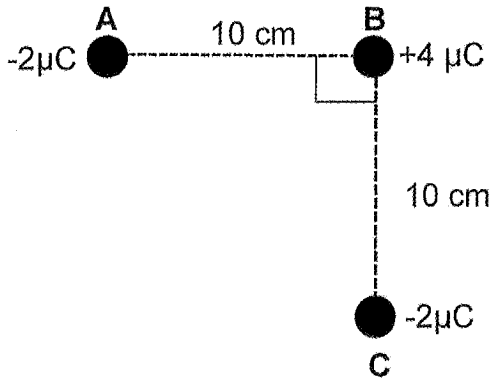
(2)

[6]

QUESTION 2

2.1 Draw the electric field pattern associated with a negative point charge. (2)

2.2 Three point charges A, B and C of magnitudes -2 μC: + 4 μC and -2 μC respectively are placed in the diagram as shown.



2.2.1 State, in words, Coulomb's Law of Electrostatics. (2)

2.2.2 Calculate the magnitude of the Coulombic Force that A exerts on B. (3)

2.2.3 Calculate the magnitude of the net Coulombic Force that charge B experiences as a result of the other two charges. (3)

2.2.4 Calculate the strength of the net electric field at B. (3)

[13]

QUESTION 3

A flat, rectangular coil consisting of 150 turns has the dimensions 25 cm by 30 cm. It is in a uniform, 1,20 T, magnetic field, with plane of the coil parallel to the field. In 0,2 s, it is rotated so that the plane of the coil is perpendicular to the field.

3.1 State *Faraday's law of electromagnetic induction* in words. (2)

3.2 Calculate the:

3.2.1 change in magnetic flux through the coil during this rotation. (3)

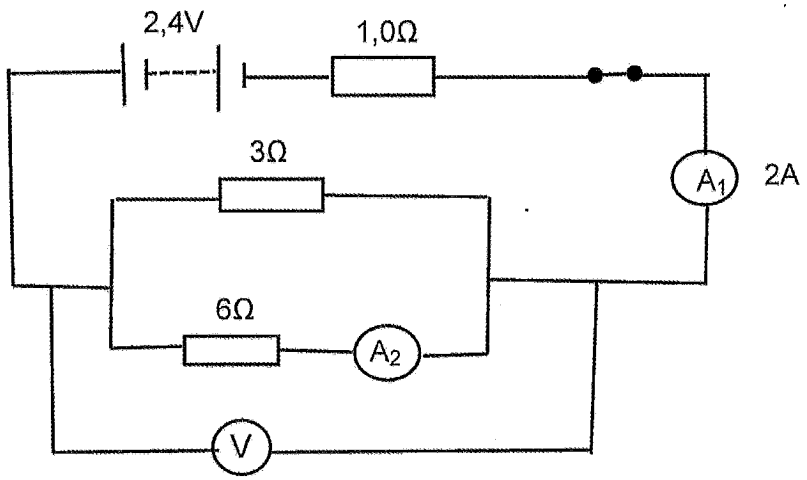
3.2.2 emf induced in the coil during this rotation. (3)

3.2.3 current induced in the coil during this rotation if the coil is connected to a resistor of 50Ω. (3)

[11]

QUESTION 4

A battery of emf 2,4 V and negligible internal resistance is connected in a circuit as shown below.
A current of 2A registers on ammeter A_1.



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

4.2 Calculate the effective resistance of the circuit. (3)

4.3 Calculate the reading on:

4.3.1 The voltmeter. (3)

4.3.2 The ammeter A_2. (3)

4.4 Calculate the amount of energy (**in kWh**) that is transferred to the circuit in 48 hours. (5)

4.5 The 3 Ω resistor is now replaced by a 6 Ω resistor?
How will this affect each of the following?
(Choose from: **INCREASES, DECREASES** OR **REMAIN THE SAME**)

4.5.1 The reading on A_1
Explain the answer. (3)

4.5.2 The reading on A_2. (1)

[20]

TOTAL MARKS: 50

DATA FOR PHYSICAL SCIENCES GRADE 11

PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	$9,8\ m{\cdot}s^{-2}$
Gravitational constant	G	$6,67 \times 10^{-11}\ N{\cdot}m^2{\cdot}kg^{-2}$
Coulomb's constant	k	$9,0 \times 10^{9}\ N{\cdot}m^2{\cdot}C^{-2}$
Speed of light in a vacuum	c	$3,0 \times 10^{8}\ m{\cdot}s^{-1}$
Charge on electron	e	$-1,6 \times 10^{-19}\ C$
Electron mass	m_e	$9,11 \times 10^{-31}\ kg$
Radius of earth	R_E	$6,38 \times 10^{6}\ m$
Mass of earth	M_E	$5,98 \times 10^{24}\ kg$

TABLE 2: FORMULAE

ELECTROSTATICS

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

ELECTROMAGNETISM

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

CURRENT ELECTRICITY

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

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

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PHYSICAL SCIENCE P1
(PHYSICS)

COMMON TEST

SEPTEMBER 2016

MEMORANDUM

NATIONAL SENIOR CERTIFICATE

GRADE 11

MARKS: 50

TIME: 1 hour

N.B. This memorandum consists of 4 pages.

QUESTION 1

1.1 C ✓✓

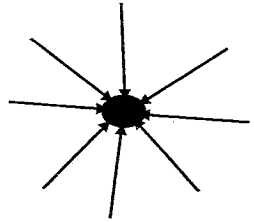
1.2 B ✓✓

1.3 B ✓✓

[6]

QUESTION 2

2.1



Criteria for marking	Marks
All field lines pointing into the charge	✓
All field lines not touching or crossing each other	✓

(2)

2.2.1 Electrostatic force that 2 charges exert on each other is directly proportional to the product of the charges and inversely proportional to the square of the distance between them. ✓✓ (2 or 0) (2)

2.2.2 $F = \frac{kQ_1Q_2}{r^2}$

N AT

$= \frac{9 \times 10^9 \times 2 \times 10^{-6} \times 4 \times 10^{-6}}{(10^{-2})^2}$

$= 720N$

2.2.3 $F^2 = 720^2 + 720^2$

$F = 1018,23\ N$

2.2.4

$$E = \frac{F}{Q}$$
$$= \frac{1018,23}{4 \times 10^{-6}}$$
$$= 254,5 \times 10^{6}\ N.C^{-1}$$

[13]

QUESTION 3

3.1 The induced emf in a conductor is directly proportional to the rate of change of magnetic flux through the circuit. ✓✓ (2)

3.2.1

$\phi_i = BCos\theta . A = 1,20\ Cos\ 90^{o} . A = 0\ Wb$✓

$\phi_f = BCos\theta . A = 1,20\ Cos\ 0 \times (0,25 \times 0,30)$ ✓ $= 0,09\ Wb$

$\Delta\phi = \phi_f - \phi_i = 0,09 - 0 = 0,09\ Wb$✓ (3)

MARK POSITIVELY FROM 3.2.2

3.2.2 $\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$✓ $= -150\frac{0,09}{0,2}$✓ $= -67,50\ V$✓ (3)

3.2.3 $I = \frac{\varepsilon}{R}$✓ $= \frac{67,50}{50}$ ✓= 1,35 A✓ (3)

[11]

QUESTION 4

4.1 The current in a metal conductor is directly proportional to the potential difference across the ends of the conductor, provided the temperature remains constant. ✓✓ (2 OR 0) (2)

4.2 $\frac{1}{Rp} = \frac{1}{R_1} + \frac{1}{R_2}$

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

$R_p = 2\Omega$

Effective Resistance = $R_p + R_s = 2 + 1$✓ $= 3\ \Omega$✓ (3)

OR

Req = $\frac{\varepsilon}{I}$✓$=\frac{2,4}{0,8}$✓$= 3\Omega$✓

4.3.1 $V = IR_{//}$✓$= 0,8 \times 2$✓ $= 1,6\ V$✓ (3)

OR

$V = IR$ ✓ $= 0,8 \times 1 = 0,8\ V$✓, therefore $V = 2,4 - 0,8 = 1,6\ V$ ✓ (3)

MARK POSITIVELY FROM 4.3.1

4.3.2

$$R = \frac{V}{I}$$ ✓
$$6 = \frac{1,6}{I}$$ ✓ (3)
$I = 0,27\ A$ ✓

4.4 $P = VI$ ✓ $= 2,4 \times 0,8$✓$= 1,92\ W = 0,00192\ kW$

$W = Pt$✓ $= 0,00192 \times 48$✓ $= 0,09216\ kWh$✓ (5)

4.5.1 Decrease ✓
-
Resistance of circuit increases. ✓From Ohms Law, R inversely proportional to current.✓ (3)

4.5.2 Increase. ✓ (1)

[20]