



Hoërskool Dr. Johan Jurgens

Physical Science Gr. 11

June 2025

Mid-year exam – Paper 1

Marks: 100

Time: 2 hours

Examiner: S Stoltz

Moderator: M Botha

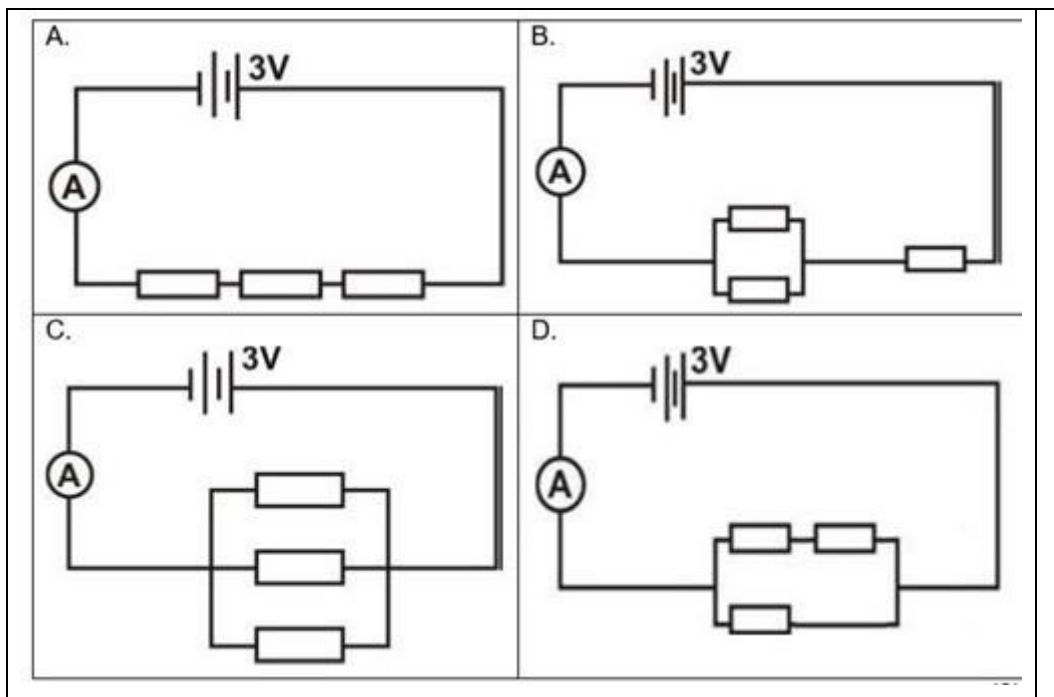
INSTRUCTIONS AND INFORMATION

1. The question paper consists of SEVEN questions. Answer ALL the questions.
2. Start EACH question on a NEW page.
3. Number your answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two sub-questions, e.g., between QUESTION 2.1 and QUESTION 2.2.
5. A non-programmable calculator may be used.
6. Appropriate mathematical instruments may be used.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your FINAL numerical answers to a minimum of TWO decimal places.
9. Give brief motivations, discussions, etc. where required.
10. You are advised to use the attached data sheets.
11. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

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

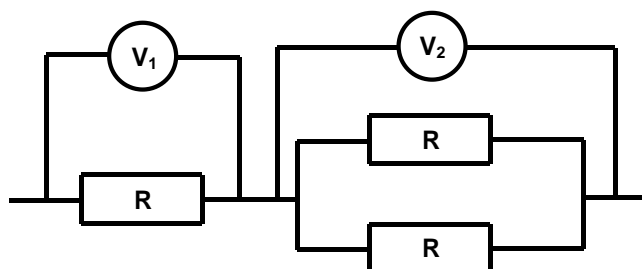
- 1.1 Three identical resistors is connected in various ways in a circuit. In which ONE of the following circuits will the largest current flow through the ammeter?



(2)

- 1.2 The accompanying diagram represents an electric circuit with identical resistors connected as shown. Which one of the following represents the ratio between the voltmeter readings when current is flowing?

- A. $V_1 = V_2 = 0$
 B. $V_1 = \frac{1}{2} V_2$
 C. $V_1 = 2 V_2$
 D. $V_1 = V_2$



(2)

- 1.3 A circular coil is placed inside a magnetic field and rotated clockwise to induce an emf.

Which ONE of the following changes will increase the induced emf?

- A. Rotating the coil slower.
 B. Decreasing the number of turns/windings of the coil.
 C. Increasing the speed of rotation of the coil.
 D. Changing the polarity of the magnets.

(2)

- 1.4 Two identical charged spheres exert an electrostatic force with magnitude F_0 on each other. If the charge on each sphere is doubled, while the distance between them is halved, the new electrostatic force exerted by the spheres on each other will be:

- A. $16 F_0$
 B. $4 F_0$
 C. F_0
 D. $\frac{1}{2} F_0$ (2)

- 1.5 Two spheres, X and Y , carry positive charges of 1 nC and 4 nC respectively. The force of X is indicated by F_x and of Y by F_y . When the magnitude of the two forces are compared it is found that:

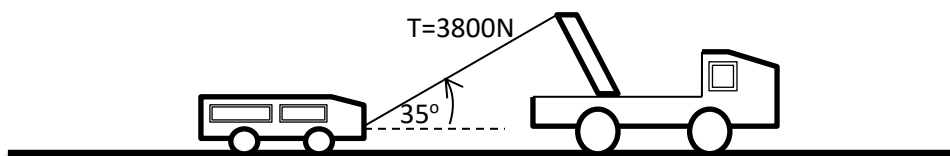


- A. $4 F_x = F_y$
 B. $F_x = F_y$
 C. $F_x = 4 F_y$
 D. $F_x = \frac{1}{4} F_y$ (2)

[10]

QUESTION 2

The diagram below shows a motor being towed at constant velocity. The cable between the motor and the truck is at 35° to the horizontal, with a tension of 3800 N.



- 2.1 State *Newton's First Law of Motion* in words. (2)
 2.2 Identify the force that causes the motor to move forward. (1)
 2.3 Draw a free-body diagram of the forces acting on the motor while in motion. (5)
 The truck and motor moves along a rough, horizontal road.
 2.4 Identify the two forces that are equal in magnitude, but in different directions. (2)
 2.5 Calculate the force of friction between the tyres of the motor and the road. (3)

[13]

QUESTION 3

- 3.1 State *Newton's Law of Universal Gravitation* in words. (2)
- 3.2 The mass of Mars is $6,4 \times 10^{23}$ kg and its radius is $3,36 \times 10^6$ m, determine the gravitational acceleration an object undergoing free-fall on Mars will experience. (4)
- 3.3 Compare the following physical quantities of an object on Mars and the Earth:
- 3.3.1 mass (1)
- 3.3.2 weight (1)
- [8]**

QUESTION 4

It is expected of Physical Sciences learners to perform an experiment to determine the relationship between the potential difference across an unknown resistor and the current through the resistor.

Kenneth and Mirriam connected the apparatus correctly and obtained the following readings:

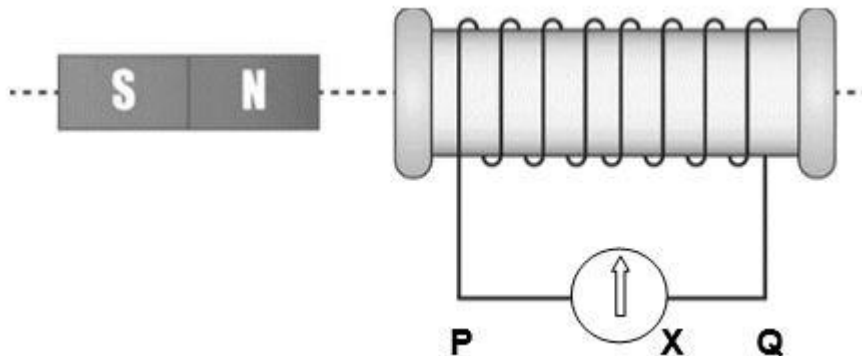
Current (A)	Potential difference (V)
0	0
0,26	1,5
0,60	3,2
0,72	4,2
0,96	5,4

- 4.1 Write an investigative question for this experiment. (2)
- 4.2 Identify the:
- 4.2.1 Dependant variable. (1)
- 4.2.2 Independent variable. (1)
- 4.2.3 Constant variable. (1)
- 4.3 Make use of an appropriate scale and draw a graph on the attached graph paper with potential difference on the vertical axis and current on the horizontal axis. (6)
- 4.4 Give the relationship between the potential difference across the unknown resistor and the current through the resistor in symbol form. (1)
- 4.5 Calculate the gradient of the graph. (4)
- 4.6 What physical quantity is represented by the gradient of the graph? (1)

- 4.7 This experiment forms the basis of an important physical law.
Give the name of this law. (1)
- 4.8 State the difference between ohmic and non-ohmic conductors and give an example of each. (2)

[20]**QUESTION 5**

Study the following figure and answer the questions that follow.

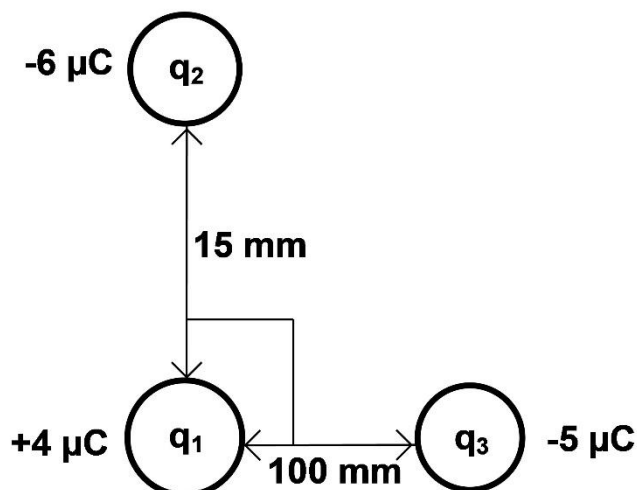


- 5.1 Write down the polarity (north pole or south pole) of the end of the coil facing the bar magnet, as the bar magnet approaches the coil. (2)
- 5.2 Give the NAME of the rule which you used in QUESTION 5.1. (1)
- 5.3 In which direction is the current flowing as the bar magnet approaches the coil?
Write only:
FROM P THROUGH DEVICE X TO Q or FROM Q THROUGH DEVICE X TO P. (1)
- 5.4 Draw the magnetic field pattern around the solenoid. (2)
- 5.5 State Faraday's law of magnetic induction in words. (2)
- 5.6 What apparatus is represented by **X**? (1)
- 5.7 What will be observed when the:
- 5.7.1 N-pole of the magnet is pushed into the solenoid? (1)
- 5.7.2 Magnet is then pulled out of the solenoid to the left? (1)
- 5.7.3 Magnet is held still inside the solenoid?
Explain your answer. (2)
- 5.8 Calculate the maximum induced emf when the magnet is pushed into the solenoid over a period of 6 s. There are 500 turns on the solenoid and the **change** in magnetic flux, while the magnet is being pushed into the solenoid, is 4 Wb. (4)
- 5.9 Name three ways in which this maximum emf can be increased. (3)

[20]

QUESTION 6

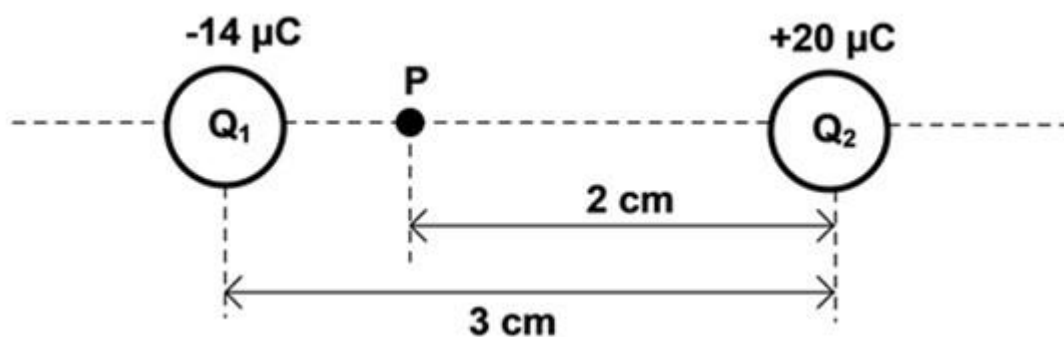
Consider the three point charges arranged as shown.



- 6.1 Give *Coulomb's law* in words. (2)
- 6.2 Draw a labelled vector diagram to show the electrostatic forces acting on q_1 . Also show the net electrostatic force (F_{net}). (3)
- 6.3 Calculate the electrostatic force exerted by q_2 on q_1 . (5)

[10]**QUESTION 7**

Two point charges, Q_1 and Q_2 , placed a distance 3 cm apart, are shown below. The charge on Q_1 is $-14 \mu\text{C}$ and the charge on Q_2 is $+20 \mu\text{C}$.

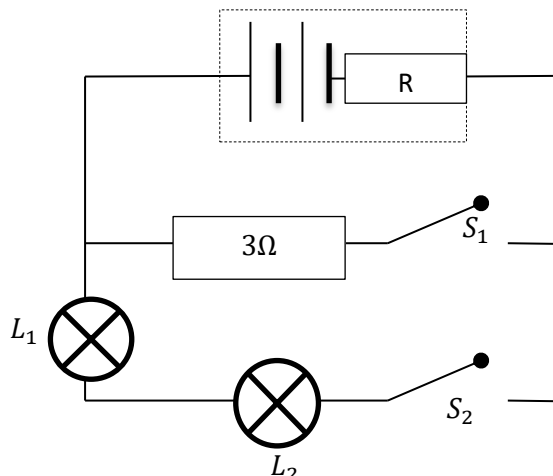


- 7.1 Define, in words, the *electric field at a point* in the space. (1)
- 7.2 Draw the electric field pattern as a result of these two charges. (2)
- 7.3 Calculate the net electric field at point P , which is 2 cm away from Q_2 as shown. (7)

[10]

QUESTION 8

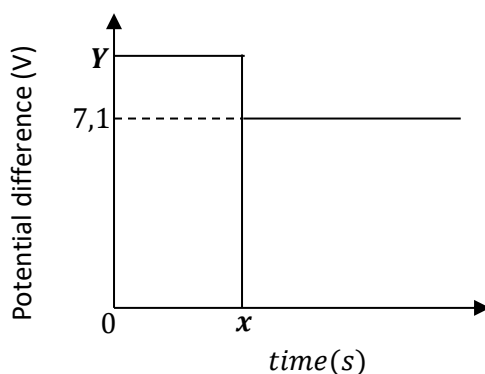
Two 6 V cells, two light bulbs and a 3Ω resistor are connected in a circuit. Switches S_1 and S_2 are open. The internal resistance of the battery is unknown. Ignore the resistance of the connecting wires.



- 8.1 Why is it a disadvantage to connect the light bulbs in the manner shown above? (1)
- 8.2 Suggest an alternative manner to the one mentioned in QUESTION 8.1 above. (1)

The potential difference across the terminals of the battery is indicated in the graph below.

From $t = 0$ to just before $t = x$ switch S_1 is open; but at $t = x$ and onwards, S_1 is closed.



- 8.3 Write down the value represented by Y on the graph. (2)
- 8.4 Determine how many volts are lost to the internal resistance of the battery. (2)
- 8.5 Calculate the current through the connected wire. (3)
- [9]**

TOTAL: 100

GEGEWENS VIR FISIESE WETENSAPPE GRAAD 11
(FISIKA)
DATA FOR PHYSICAL SCIENCES GRADE 11
(PHYSICS)

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIESE KONSTANTES

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Acceleration due to gravity <i>Swaartekragversnelling</i>	g	9,8 m·s ⁻²
Speed of light in a vacuum <i>Spoed van lig in 'n vakuum</i>	c	3,0 x 10 ⁸ m·s ⁻¹
Planck's constant <i>Planck se konstante</i>	h	6,63 x 10 ⁻³⁴ J·s
Charge on electron <i>Lading op elektron</i>	e ⁻	-1,6 x 10 ⁻¹⁹ C
Electron mass <i>Elektronmassa</i>	m _e	9,11 x 10 ⁻³¹ kg
Radius of earth <i>Radius van aarde</i>	R _E	6,38 x 10 ³ km
Universal gravitational constant <i>Universelegravitasiekonstant</i>	G	6,67 x 10 ⁻¹¹ N·m ² ·kg ⁻²
Mass of earth <i>Massa op aarde</i>	M	5,98 x 10 ²⁴ kg
Coulomb's constant <i>Coulomb se konstante</i>	k	9,0 x 10 ⁹ N·m ² ·C ⁻²

TABLE 2: FORMULAE/TABEL 2: FORMULES**MOTION/BEWEGING**

$v_f = v_i + a \Delta t$	$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$
$v_f^2 = v_i^2 + 2a \Delta x$	$\Delta x = \left(\frac{v_f + v_i}{2} \right) \Delta t$

WORK, ENERGY AND POWER/ARBEID, ENERIE EN DRYWING

$K = E_k = \frac{1}{2} m v^2$	$U = E_p = mgh$
$E_M = E_k + E_p$ or/of $E_M = K + U$	

WAVES, LIGHT AND SOUND/GOLWE, LIG EN KLANK

$v = f \lambda$	$T = \frac{1}{f}$
$E = hf$ or/of $E = h \frac{c}{\lambda}$	

ELECTROSTATICS/ELEKTROSTATIKA

$n = \frac{Q}{e}$	$Q = \frac{Q_1 + Q_2}{2}$
$E = \frac{F}{q}$	$E = \frac{kQ}{r^2}$

ELECTRIC CIRCUITS/ELEKTRIESE STROOMBANE

$R = \frac{V}{I}$	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$
$R_s = R_1 + R_2 + \dots$	$Q = I\Delta t$
$V = \frac{W}{Q}$	$\Phi = BA \cos \theta$
	$\varepsilon = -N \frac{\Delta \Phi}{\Delta t}$

