Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 10

NOVEMBER 2020

PHYSICAL SCIENCES: PHYSICS P1 (EXEMPLAR)

MARKS: 150

TIME: 2 hours

This question paper consists of 15 pages including 1 data sheet.

INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of ELEVEN questions. Answer ALL the 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 calculator.
7. You may use appropriate mathematical instruments.
8. Show ALL formulae and substitutions in ALL calculations.
9. Round off your FINAL numerical answers to a minimum of TWO decimal places.
10. Give brief motivations, discussions, et cetera where required.
11. You are advised to use the attached DATA SHEETS.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1–1.10) in the ANSWER BOOK, for example 1.11 D.

1.1 Which ONE of the following is a vector quantity?

A Force

B Time

C Speed

D Distance (2)

1.2 Which ONE of the following quantities is given with its CORRECT SI unit?

	QUANTITY	UNIT
A	Acceleration	m/s^{-2}
B	Displacement	km
C	Time	s^{-1}
D	Frequency	Hz

(2)

1.3 An object undergoes constant acceleration.

Constant acceleration means that in equal time intervals:

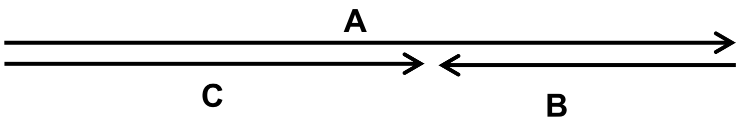
A Speed of an object is constant

B Velocity of an object is constant

C Velocity of an object changes by the same amount

D Displacement of an object changes by the same amount (2)

1.4 Consider the vector diagram given below.



Which ONE of the following CORRECTLY describes the relationship between vectors **A**, **B** and **C**?

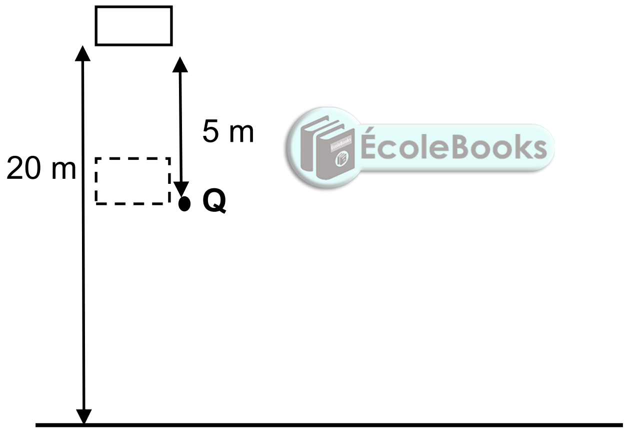
A A + B + C = 0

B A + B = C

C A + C = B

D B + C = A (2)

1.5 A block of mass **m** falls vertically down from rest. The block falls for a vertical distance of 5 m below its initial height (at point **Q**) as shown in the diagram below.



When the block reaches point **Q,** the kinetic energy that it has gained in terms of **m** (mass of block) and **g** (gravitational acceleration) is equal to …

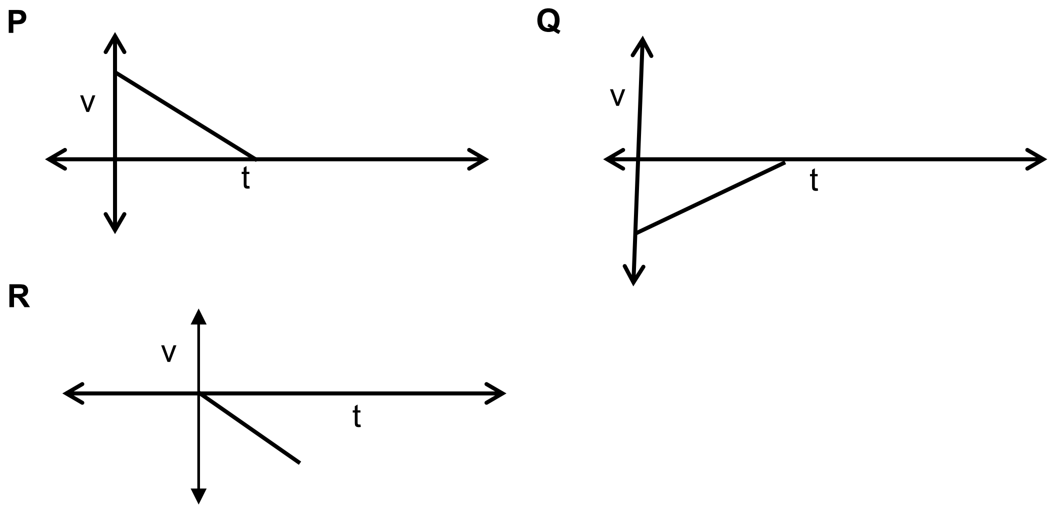
A 0.

B 15 **mg**.

C 5 **mg**.

D 20 **mg**. (2)

1.6 Consider the three velocity-time graphs **P**, **Q** and **R** shown below.



Which ONE(S) of the following velocity-time graphs represent the motion of an object whose velocity is decreasing uniformly?

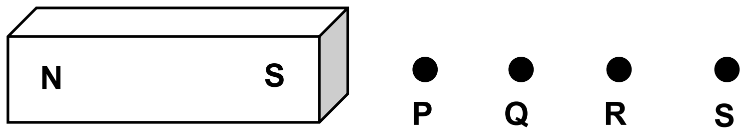
A **R** only

B **Q** only

C **P** and **Q**

D **P** and **R**

1.7 The diagram below represents a bar magnet. **P**, **Q**, **R** and **S** are points at certain distances from the south pole of the magnet as shown in the diagram below.



At which point is the magnitude of the magnetic field of the bar magnet the WEAKEST?

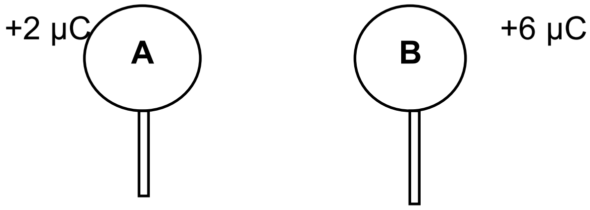
A **P**

B **Q**

C **R**

D **S** (2)

1.8 Two identical spheres **A** and **B** placed on insulated stands, carry charges of +2 μC and +6 μC, respectively as shown below.



When the spheres are brought into contact, in which direction do electrons move?

A From **A** to **B**

B From **B** to **A**

C No movement as both spheres are positively charged

D No movement, electrons remain in **A** (2)

1.9 The dimensions of four pieces of copper of equal length and the temperature of each wire are given below.

Which ONE of the four wires will provide the GREATEST resistance to the flow of charge?

A 5 cm in diameter at 15 °C

B 5 cm in diameter at 85 °C

C 2 cm in diameter at 85 °C

D 2 cm in diameter at 15 °C (2)

1.10 In which ONE of the following do sound waves travel the FASTEST?

A Air

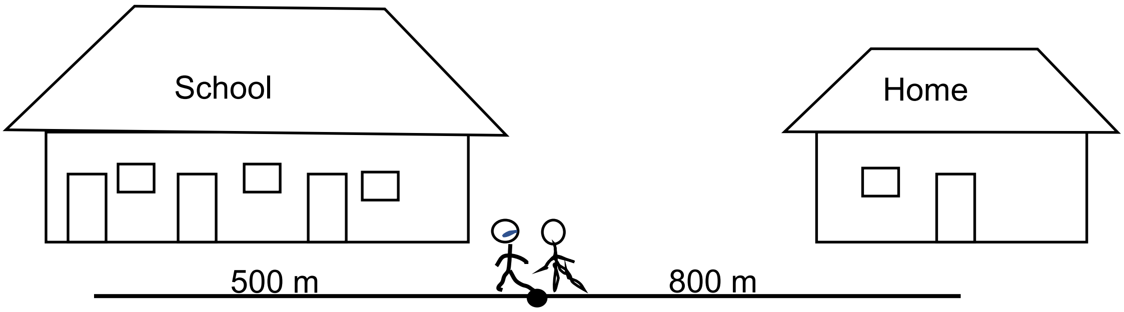
B Liquids

C Solids

D Vacuum (2)
[20]

QUESTION 2

2.1 A brother and sister walk home from school. After walking 500 m eastward, the brother realises that he has left a book at school and he returns to school. His sister continues walking another 800 m to their home. She arrives home 30 minutes after leaving school.



2.1.1 Define the term *average speed.* (2)

2.1.2 Calculate the average speed of the girl from school to her home. (3)

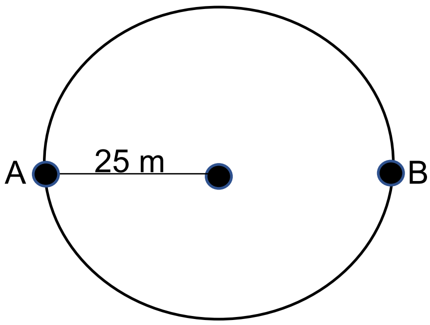
2.1.3 Use a vector scale diagram and represent the displacement of the boy from the time he realised he had left his book at school until he reached home. Include all the relevant information in the diagram.

Use scale 1 cm = 100 m for the diagram. (3)

2.1.4 Calculate how long it would take the boy to reach home, from the time they both left the school together if the average speed of the boy is 0,72 $m.s^{-1}$ (4)

2.2 A girl travels around a circular path from point **A** to point **B**. The radius of the circular path is 25 m.

Point **B** is directly east of point **A.**



Calculate the:

2.2.1 Distance travelled by the girl (3)

2.2.2 Displacement of the girl (2)

[17]

QUESTION 3

A van is travelling at a constant speed of 54 $km.h^{-1}$ in a straight and level road where the speed limit is 40 $km.h^{-1}$.

3.1 Define the term *acceleration.* (2)

3.2 Convert 54 $km.h^{-1}$ to $m.s^{-1}$. (3)

A policeman starts his car from rest just as the van passes him. The police car accelerates uniformly at 2 $m.s^{-2}$ until it reaches a maximum velocity of 20 $m.s^{-1}$.

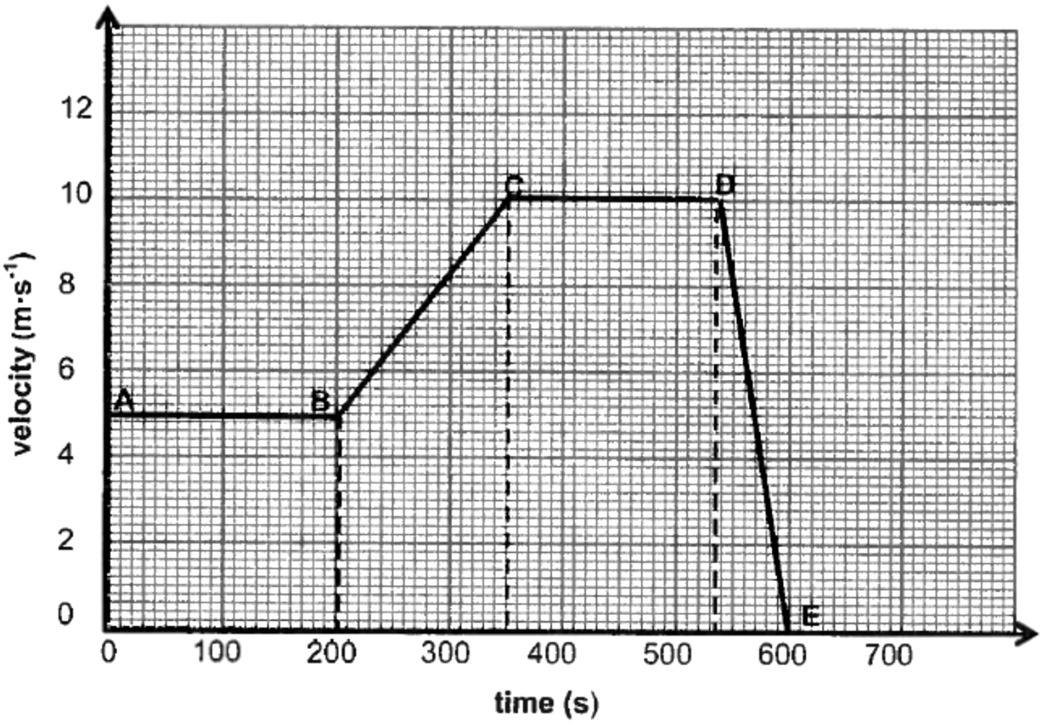
3.3 Calculate the time **t** it takes the police car to reach its maximum velocity. (4)

3.4 Determine by calculation which vehicle (the van or the police car) is ahead at time **t** seconds (mentioned in QUESTION 3.3 above).

Assume that the van maintains its constant speed. (6)
[15]

QUESTION 4

The velocity time graph below represents the motion of a girl riding her bicycle in an easterly direction on a straight, level road.



4.1 Write down the:

4.1.1 Girl's initial velocity (2)

4.1.2 Magnitude of the girl's velocity at t = 300 s (2)

4.2 Use the information from the graph to describe the girl's motion:

4.2.1 From **B** to **C** (2)

4.2.2 From **C** to **D** (2)

4.3 Without using equations of motion, calculate EACH of the following:

4.3.1 Distance covered by the girl from **A** to **C** (4)

4.3.2 Acceleration of the girl from **D** to **E** (4)

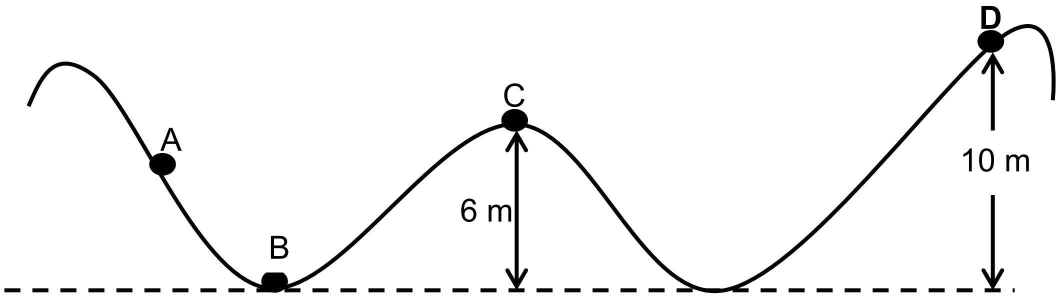
4.4 Give a reason using information from the graph why it can be concluded that the acceleration of the girl is HIGHEST during the interval **D** to **E**. (2)

[18]

QUESTION 5

A steel ball of mass 5 kg is rolling over a frictionless surface, as shown below. When the ball reaches point **A** it has mechanical energy of 490 J.

Point **B** is on the ground.



5.1 State the principle of conservation of mechanical energy in words. (2)

5.2 Use your knowledge of the principle of conservation of mechanical energy to write down the value of the:

5.2.1 Gravitational potential energy of the ball at point **B**. (1)

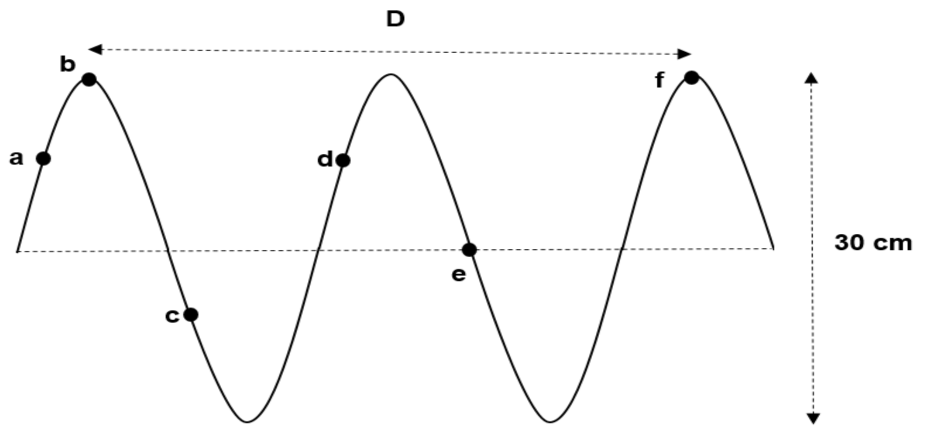
5.2.2 Total mechanical energy at point **C**. (1)

5.3 Calculate the gravitational potential energy of the ball at point **C**. (3)

5.4 Determine by calculation whether the ball will reach point **D**. (5)
[12]

QUESTION 6

6.1 The figure below shows transverse wave motion. The period of the wave is 0,2 s.



Calculate the:

6.1.1 Frequency of the wave. (3)

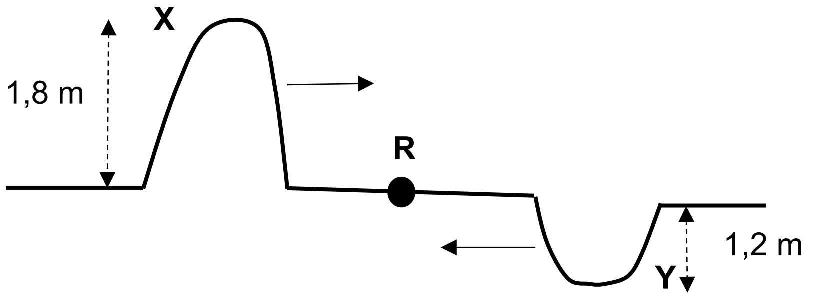
6.1.2 Speed of the wave if distance **D** equals to 3 metres. (4)

Write down:

6.1.3 TWO pairs of points which are in phase. (2)

6.1.4 The amplitude of the wave motion. (2)

6.2 Two pulses **X** and **Y** move towards each other at the same speed. The amplitude of pulse **X** is 1,8 m and the amplitude of pulse **Y** is 1,2 m. The pulses meet at point **R**.



6.2.1 Define a *pulse.* (2)

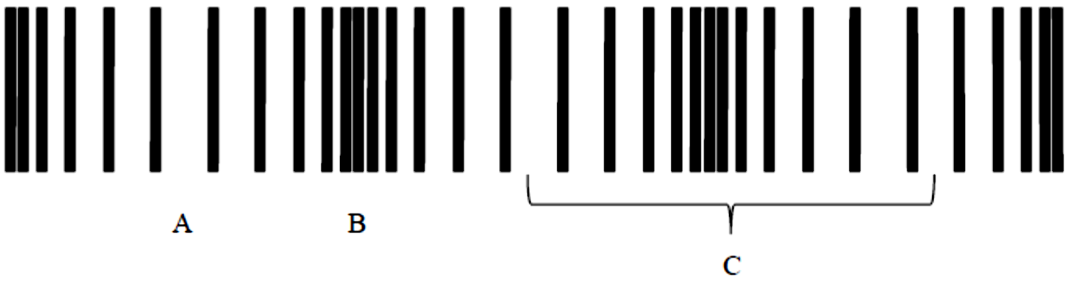
6.2.2 What is the name given to the type of interference that occurs at point **R**? (1)

6.2.3 Draw the resultant of two pulses at point **R.**
(Indicate the resultant amplitude of the pulses in your diagram) (2)

[16]

QUESTION 7

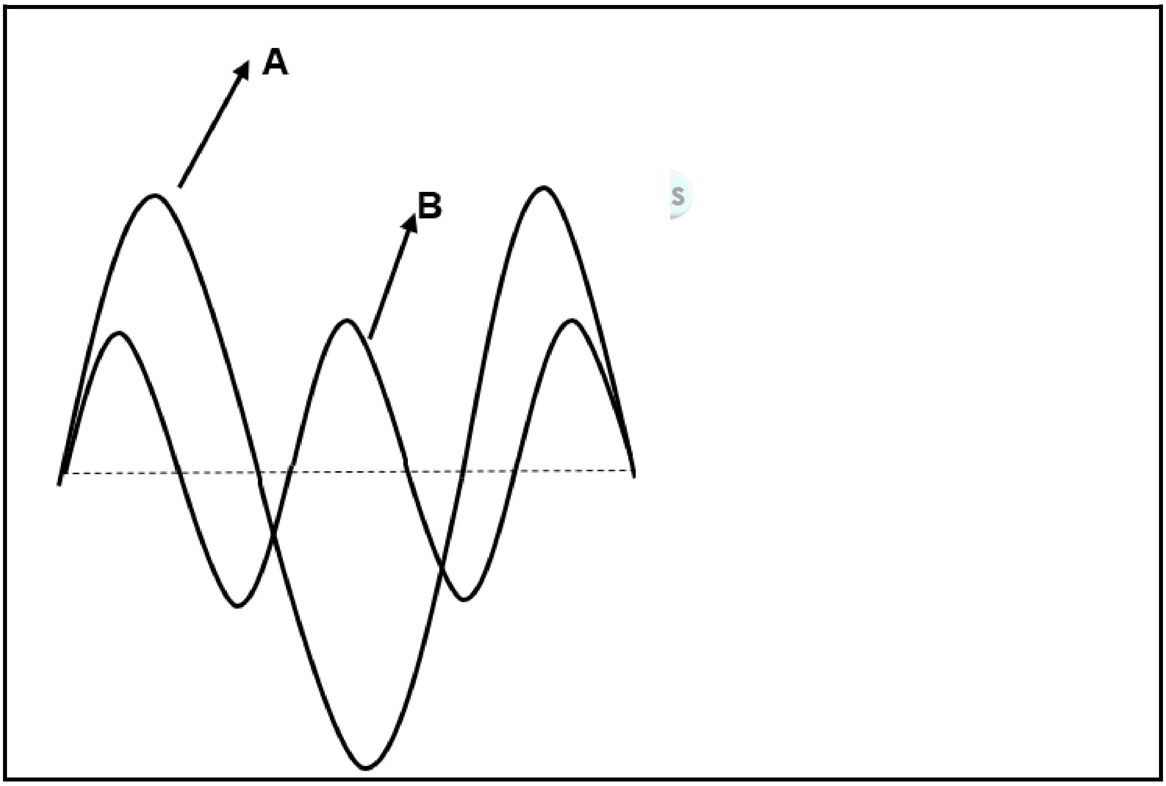
7.1 The diagram below shows different points on a longitudinal wave.



7.1.1 Write down the labels for **A, B** and **C.** (3)

7.1.2 Does this type of wave require a medium to propagate?
Write down: YES or NO. (1)

7.2 The diagram shows TWO sound waves measured for the same time interval.



7.2.1 Which ONE of the sound waves has a HIGHER pitch? Explain the answer. (3)

7.2.2 Which ONE of the sound waves (**A** or **B**), is LOUDER? (1)

QUESTION 8

8.1 Electromagnetic radiation has a wave-particle duality.
What does this mean? (2)

8.2 Arrange the following types of electromagnetic radiations in order of decreasing wavelength.

Infrared, gamma ray, visible light, x-ray (2)

8.3 Define a *photon.* (2)

An electromagnetic wave has a wavelength of 2,5 x 10^{-9} m.

8.4 Calculate the amount of energy that a photon of this wave has. (6)
[12]

QUESTION 9

9.1 Define a *magnetic field.* (2)

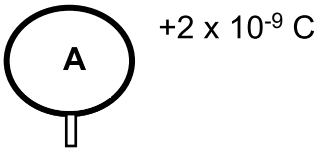
9.2 The diagram below shows a bar magnet.

Draw the magnetic field pattern associated with the bar magnet. (3)

9.3 Is it possible for a magnet to have one pole? Yes or No. (1)
[6]

QUESTION 10

10.1 A small, metal sphere **A** carrying a charge of $+2 \times 10^{-9}$ C is placed on an insulated stand.



10.1.1 How does the number of electrons compare with the number of protons in sphere **A**?

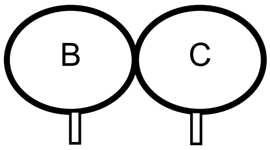
Choose from LESS THAN, GREATER THAN or EQUAL TO. (1)

*10^{13} electrons are now added to sphere **A***

10.1.2 Calculate the new charge on sphere **A**. (4)

10.2 Two identical metal spheres **B** and **C** placed on insulated stands, carry charges $+4 \times 10^{-6}$ C and -6×10^{-6} C respectively as shown in the diagram below.

The spheres are allowed to touch each other.



After touching the spheres are then separated and brought back to their original positions as shown in the diagram below.

10.2.1 State the principle of conservation of charge. (2)

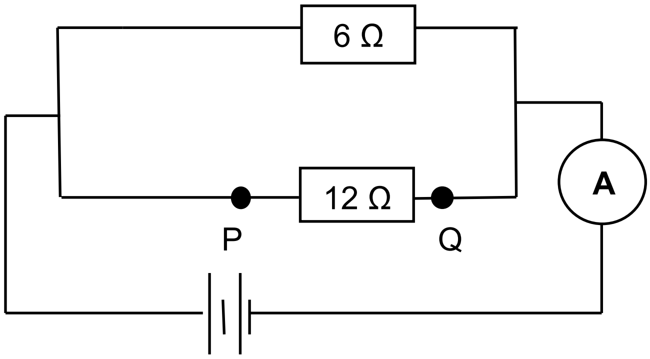
10.2.2 Calculate the number of electrons transferred between the two spheres during contact. (6)

[13]

QUESTION 11

11.1 Define the term *potential difference.* (2)

11.2 In the electric circuit given below, the ammeter and connecting wires have negligible resistance and the battery have no internal resistance.



11.2.1 Calculate the total resistance of the circuit. (3)

11.2.2 Calculate the amount of charge that flows through the 6 Ω in 40 seconds if the reading on the ammeter is 0,9 A. (5)

11.2.3 How does potential difference across the 6 Ω resistor and potential difference across the 12 Ω resistor compare?

Write down only HIGHER ACROSS 6 Ω, LOWER ACROSS 6 Ω or THE SAME AS (1)

A low resistance copper wire is now connected between points **P** and **Q**.

11.2.4 Will the reading on the ammeter INCREASE, BECOME ZERO or DECREASE?

Give a reason for your answer. (2)
[13]

TOTAL: 150

DATA FOR PHYSICAL SCIENCES GRADE 10

DATA VIR FISIESE WETENSKAPPE GRAAD 10

PAPER 1 (PHYSICS) / *VRAESTEL 1 (FISIKA)*

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

NAME / *NAAM*	SYMBOL / *SIMBOOL*	VALUE / *WAARDE*
Acceleration due to gravity *Versnelling as gevolg van gravitasie*	*g*	9,8 $m \cdot s^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	3,0 x 10^8 $m \cdot s^{-1}$
Planck's constant *Planck se konstante*	h	6,63 x 10^{-34} J.s
Charge on electron *Lading op elektron*	e^-	-1.6 x 10^{-19} C

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

MOTION / *BEWEGING*

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

WEIGHT AND MECHANICAL ENERGY / *GEWIG EN MEGANIESE ENERGIE*

$F_g = mg$	$U = E_p = mgh$	$E_k = \frac{1}{2}mv^2$	$E_m = (E_k + E_p)_i = (E_k + E_p)_f$

WAVES, LIGHT AND SOUND / *GOLWE, LIG EN KLANK*

$v = f\lambda$	$T = \frac{1}{f}$	$E = hf$ $\quad E = h\frac{c}{\lambda}$
$\Delta x = v\Delta t$	$n = \frac{c}{v}$	$c = f\lambda$

ELECTRICITY AND MAGNETISM / *ELEKTRISITEIT EN MAGNETISME*

$I = \frac{Q}{\Delta t}$	$V = \frac{W}{Q}$	$R = \frac{V}{I}$	$Q = \frac{Q_1 + Q_2}{2}$
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$	$R_s = R_1 + R_2 + \ldots$	$n = \frac{Q}{e}$	