basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES: PHYSICS (P1)

NOVEMBER 2016

MARKS: 150

TIME: 2 hours

This question paper consists of 16 pages, 1 answer sheet and 2 data sheets.

XPSCE1

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INSTRUCTIONS AND INFORMATION

1. Write your name and class (for example 10A) in the appropriate spaces on the ANSWER BOOK.

2. This question paper consists of 11 questions. Answer ALL the questions in the ANSWER BOOK, except QUESTION 7.3 which must be done on the graph on the attached ANSWER SHEET. Ensure that you hand in the ANSWER SHEET together with 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 subquestions, 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. 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.

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

12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

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 the ANSWER BOOK, for example 1.11 E.

1.1 Which ONE of the following physical quantities is a vector?

A Distance

B Displacement

C Mass

D Time (2)

1.2 In the equation $v_f = v_i + a\Delta t$, the SI unit for $a\Delta t$ is …

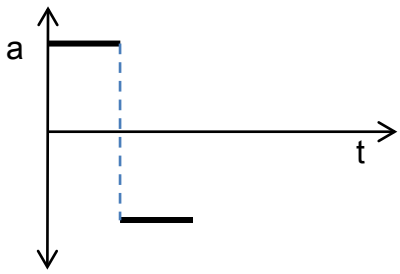
A m

B $m \cdot s^{-2}$

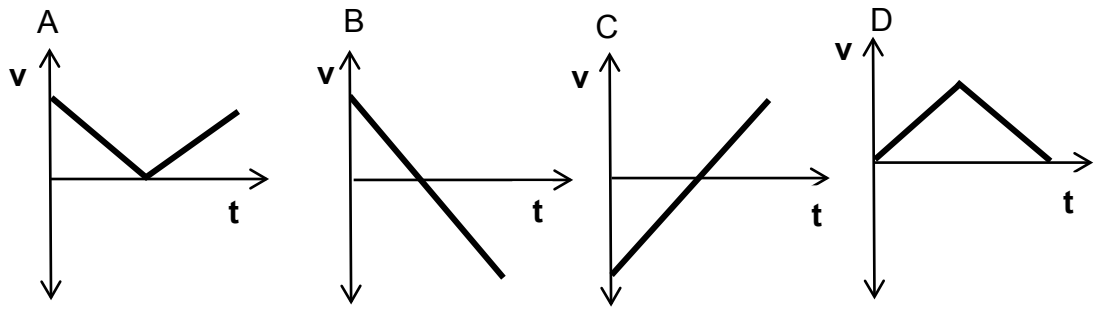
C $m \cdot s^{-1}$

D s^{-1} (2)

1.3 Consider the acceleration-time graph of an object in motion below.



Which ONE of the graphs below represents the velocity-time graph of the object?



(2)

1.4 A wave in which the particles of the medium vibrate at right angles to the path along which the wave travels through the medium, is produced by …

A a bat.

B a car's hooter.

C an ambulance.

D an X-ray machine. (2)

1.5 The number of waves passing a point every second is defined as the … of the wave.

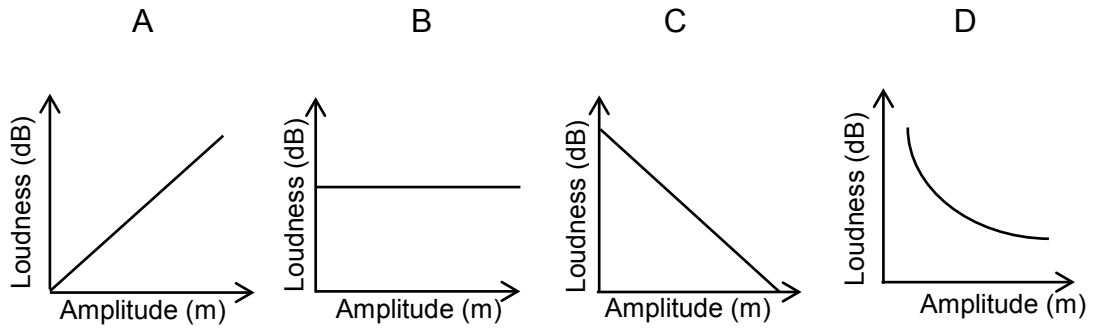
A speed

B amplitude

C wavelength

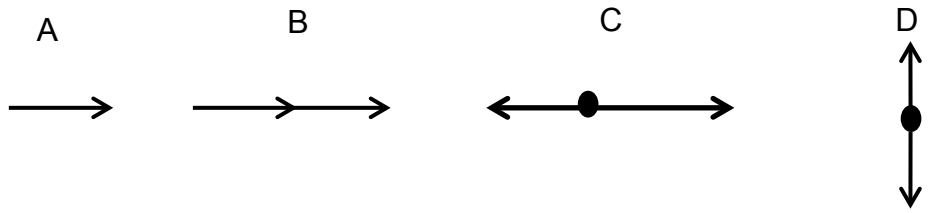
D frequency (2)

1.6 Which ONE of the graphs below best describes the relationship between loudness and the amplitude of a wave?



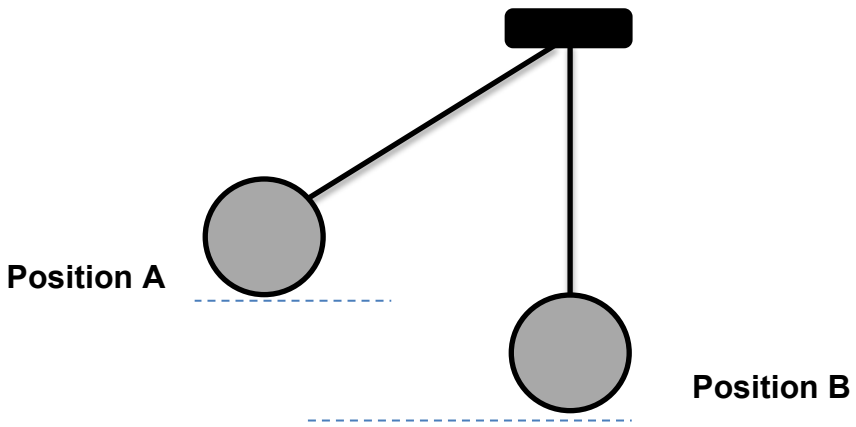
(2)

1.7 Which ONE of the vector diagrams below will result in the largest resultant vector?



(2)

1.8 A sphere is released from point A, as shown in the diagram below. It reaches point B, which is the lowest point of its swing. Ignore the effects of air friction.



Which ONE of the statements below regarding the energy of the system is CORRECT?

A The kinetic energy at **A** is equal to the mechanical energy at **A**.

B The gravitational potential energy at **A** is equal to the kinetic energy at **B**.

C The sum of the kinetic energy and gravitational potential energy at **A** is equal to the sum of the kinetic energy and gravitational potential energy at **B**.

D The kinetic energy at **A** is equal to the gravitational potential energy at **B**. (2)

1.9 A rubber balloon obtains a negative charge after it has been rubbed against human hair.

Which ONE of the statements below best explains why this happens?

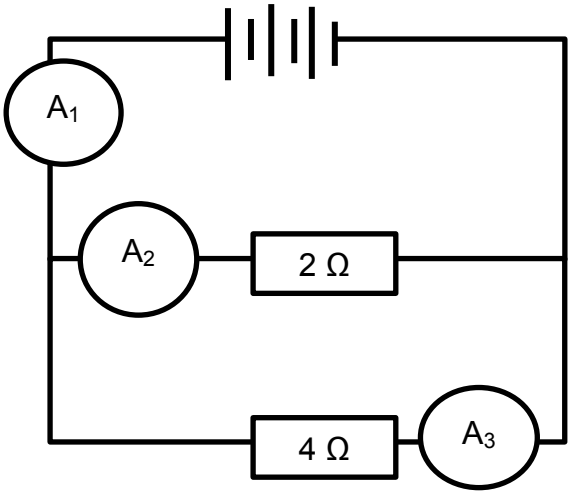
A Negative charges are transferred from the rubber balloon to the human hair.

B Positive charges are transferred from the rubber balloon to the human hair.

C Positive charges are transferred from the human hair to the rubber balloon.

D Negative charges are transferred from the human hair to the rubber balloon. (2)

1.10 Consider the circuit diagram below.



How will the readings on ammeters A_1, A_2 and A_3 compare with each other?

A $A_1 = A_2 = A_3$

B $A_1 = A_2 + A_3$

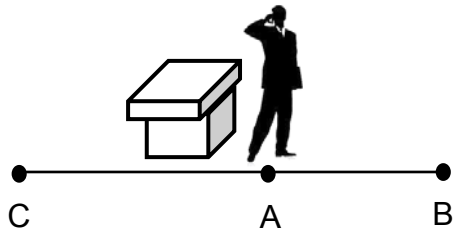
C $(A_2 + A_3) > A_1$

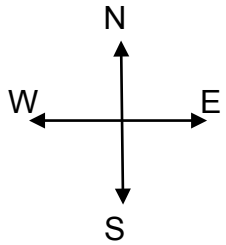
D $A_2 < A_3 < A_1$ (2)

[20]

QUESTION 2 (Start on a new page.)

An impatient businessman paces up and down while making a business call on his cellphone.





He starts at his desk and walks 5 m east (from A to B) and then walks 7 m west (from B to C). This process takes him 20 s.

2.1 Use a vector scale diagram and represent the two displacements of the man (from A to B AND from B to C). Label ALL the vectors clearly and write down the displacements next to the vectors.
Use a scale of 1 cm representing 1 m for your diagram. (2)

2.2 What is the businessman's *change in position* at **C** relative to **A**? (2)

2.3 Calculate the total distance the man covers. (2)

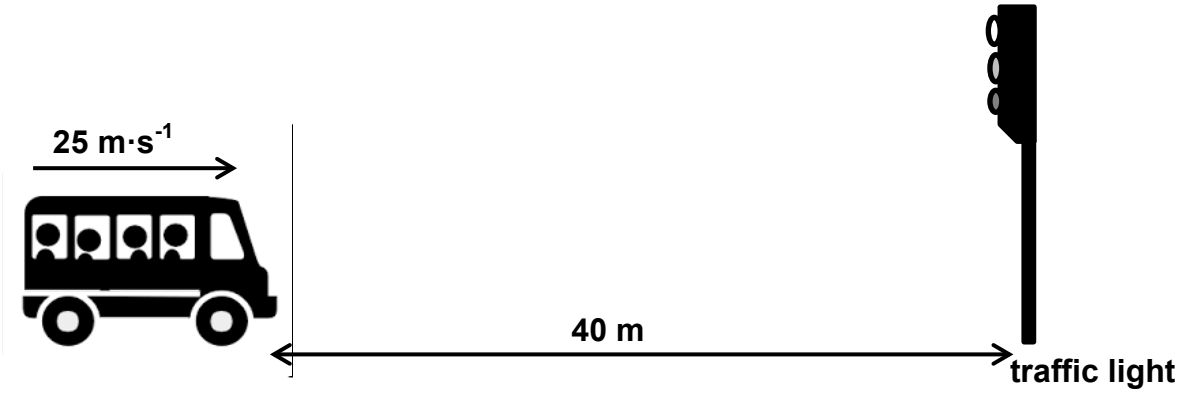
2.4 Explain why the value calculated in QUESTION 2.2 differs from the one calculated in QUESTION 2.3. (2)

2.5 Define the term *velocity*. (2)

2.6 Calculate the man's *average velocity*. (4)
[14]

QUESTION 3 (Start on a new page.)

A taxi is travelling at a speed of 25 $m \cdot s^{-1}$ when a traffic light, 40 m ahead, changes to red.



3.1 Define the term *acceleration*. (2)

The driver takes 1 s to react (reaction time) before he slams on the brakes. The taxi then stops within 2 s.

3.2 Is the velocity and acceleration of the *braking* taxi in the SAME DIRECTION as it moves towards the traffic light? (1)

3.3 Give a reason for the answer to QUESTION 3.2. (1)

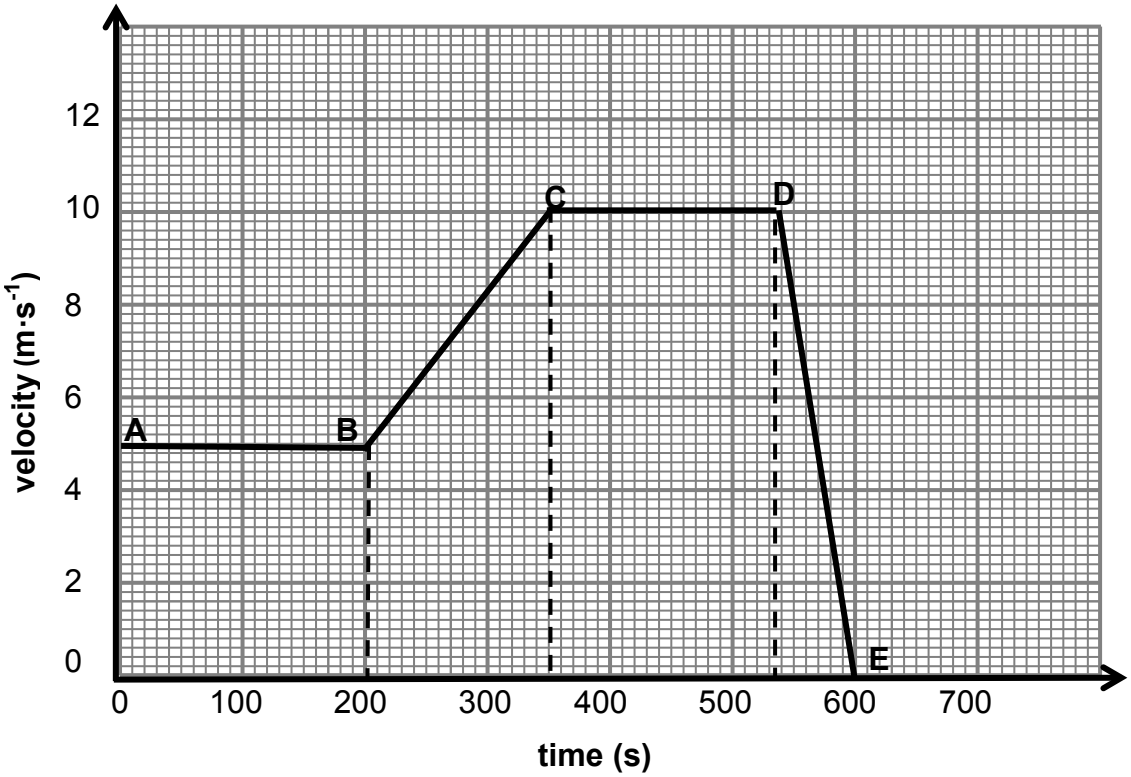
3.4 Calculate the distance the taxi travels during the reaction time. (4)

3.5 Will the taxi stop at the traffic light? Show ALL calculations. (5)

3.6 Draw a position versus time graph for the motion of the taxi. (4)
[17]

QUESTION 4 (Start on a new page.)

The velocity-time graph below represents the motion of a girl riding her bicycle in a northerly direction.



4.1 Write down the girl's initial velocity. (2)

4.2 Write down the magnitude of the girl's velocity at 300 s. (2)

4.3 Use the information on the graph to describe the motion of the girl:

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

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

4.4 WITHOUT USING EQUATIONS OF MOTION, calculate each of the following:

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

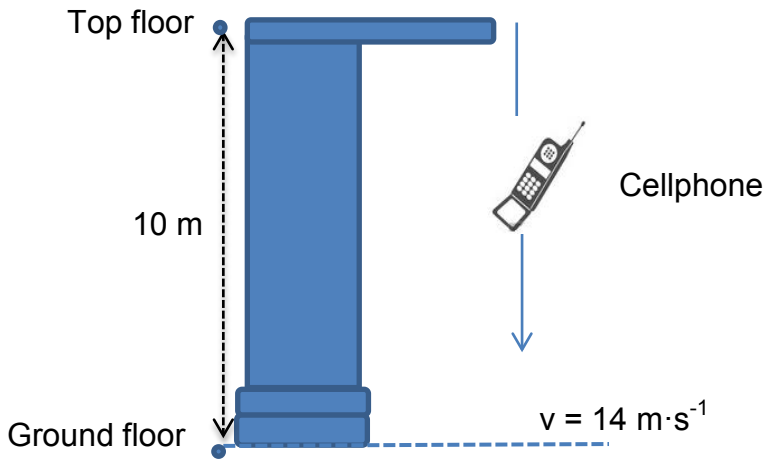
4.4.2 Acceleration of the girl from **D** to **E** (4)

4.5 During which stages of the journey is the change in speed the greatest? (2)

4.6 Explain the answer to QUESTION 4.5. (2)
[20]

QUESTION 5 (Start on a new page.)

A woman is at the shopping mall 10 m above the ground. Her cellphone, with a mass of 0,01 kg, falls and hits the ground at a speed of 14 $m \cdot s^{-1}$. Ignore the effects of air resistance.



5.1 Convert 14 $m \cdot s^{-1}$ to $km \cdot h^{-1}$. (2)

5.2 Define the term *kinetic energy*. (2)

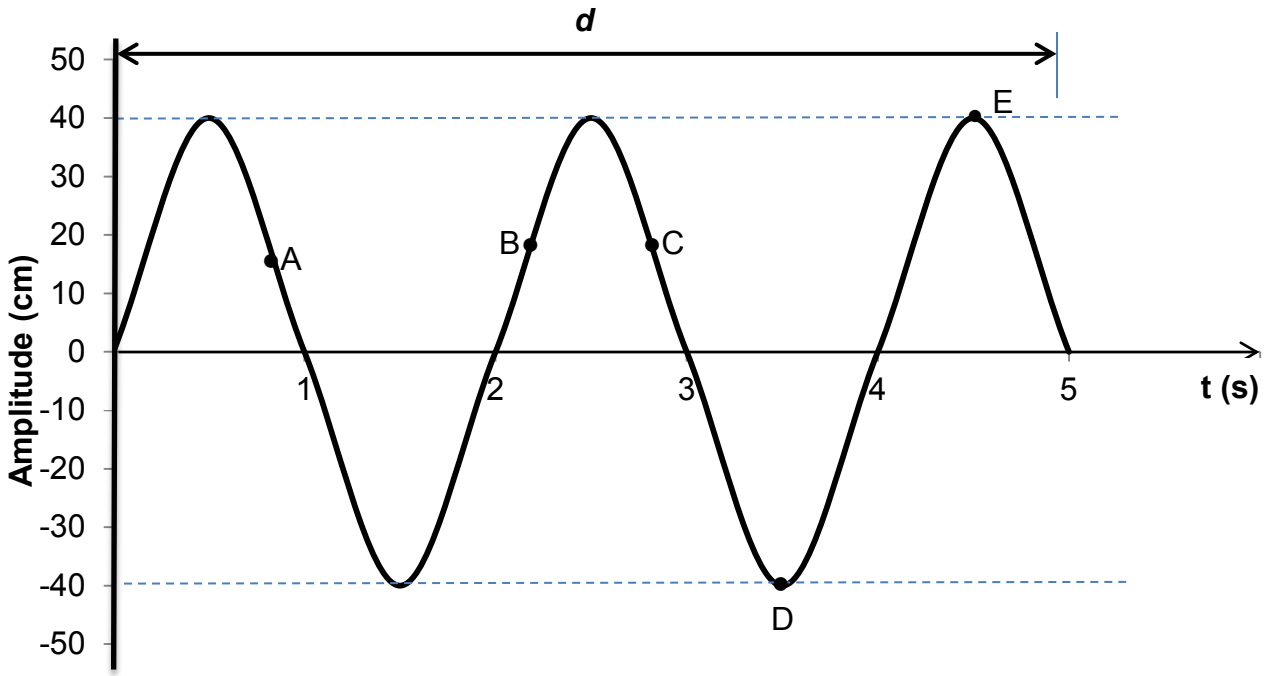
5.3 Calculate the gravitational potential energy of the cellphone at a height of 5 m above the ground. (3)

5.4 Calculate the velocity of the cellphone at a height of 5 m above the ground. (4)

5.5 Will the value of the cellphone's mechanical energy just before it hits the ground be GREATER THAN, LESS THAN or EQUAL TO the mechanical energy at a height of 5 m? Explain the answer. (3)
[14]

QUESTION 6 (Start on a new page.)

The diagram below is a graphical representation of a transverse wave moving from left to right across the page. The wave is moving at a speed of 0,4 $m \cdot s^{-1}$ and has a frequency of 0,5 Hz. A, B, C, D and E represent points on the wave.



6.1 Write down the amplitude of the wave in metres. (2)

6.2 Label the points marked:

6.2.1 D (1)

6.2.2 E (1)

6.3 Write down TWO points on the graph above that are in phase. (1)

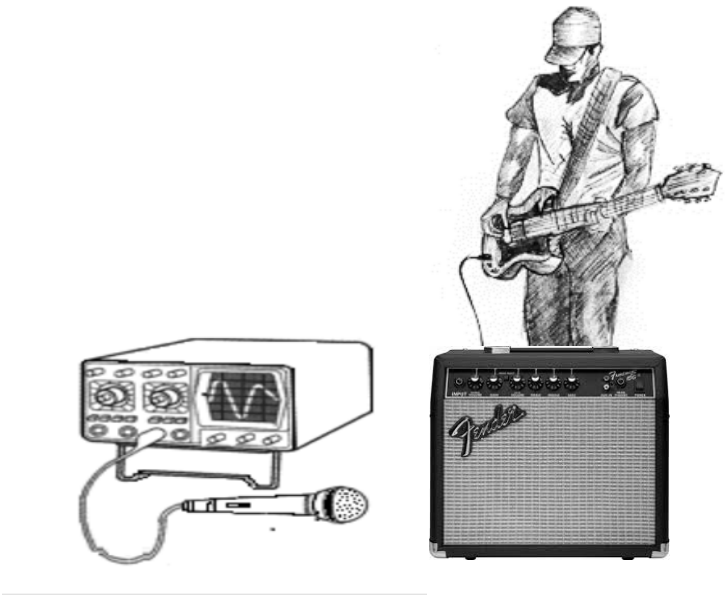
6.4 How many waves are represented in the diagram above? (2)

6.5 Calculate the wavelength of the wave. (3)

6.6 Determine distance ***d*** in the diagram. Show how you arrived at the answer. (2)
[12]

QUESTION 7 (Start on a new page.)

A band decides to do an experiment on sound during one of their practice sessions. The diagram below shows a musician playing specific notes on the electric guitar. The guitar is plugged into a speaker to amplify the sound.



[Source: goyalkunal91.deviantart.com]

A microphone is connected to an oscilloscope so that the frequency of the sound can be measured.

The table below represents the data of the notes played by the musician.

NOTE PLAYED BY THE MUSICIAN	WAVELENGTH OF THE NOTE (m)	FREQUENCY OF THE NOTE (Hz)
W	3	110
X	6	55
Y	9	37
Z	12	27

7.1 Write down the independent variable. (1)

7.2 Write down the dependent variable. (1)

7.3 Draw a graph of the data by plotting the frequency (y-axis) versus the wavelength (x-axis) of each note played by the musician. Use the graph paper provided on the attached ANSWER sheet. (4)

7.4 Use the graph in QUESTION 7.3 to determine the mathematical relationship between the frequency and wavelength of the notes. (1)

7.5 Use the information for note **X** to calculate the speed of the sound. (3)

[10]

QUESTION 8 (Start on a new page.)

Different types of electromagnetic radiation have different frequencies. This can influence their properties and what each could be used for in our daily lives.

8.1 Choose the frequency from COLUMN B that matches the type of electromagnetic radiation in COLUMN A. Write only the letter (A–C) next to the question number (8.1.1–8.1.3) in the ANSWER BOOK, for example 8.1.4 D.

COLUMN A TYPE OF RADIATION		COLUMN B FREQUENCY IN Hz	
8.1.1	Ultraviolet	A	10^{23}
8.1.2	Gamma	B	10^{7}
8.1.3	Radio	C	10^{16}

(3 x 1) (3)

8.2 Write down ONE use of each of the following types of radiation:

8.2.1 Infrared (1)

8.2.2 Microwaves (1)

8.3 When doctors need to establish the seriousness of a fracture, a picture is taken of the broken bone. The picture below shows a fracture.

[Source: learning radiography.com]

Write down the following:

8.3.1 Name of the type of radiation used for this procedure (1)

8.3.2 Property of this type of radiation which enables it to perform this procedure (1)

8.3.3 Danger of overexposure to this type of radiation (1)

8.4 A radio programme is transmitted in the FM band on a wavelength of 3 m.

Calculate the energy of a photon of the radio wave. (4)

[12]

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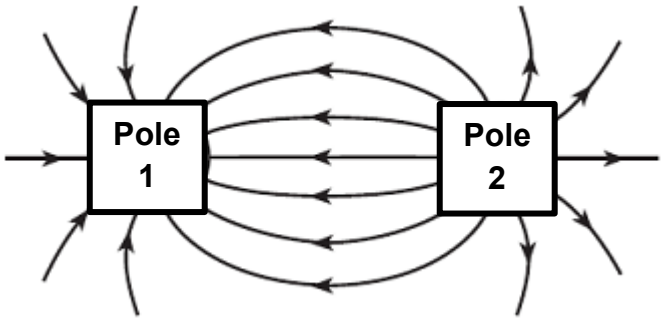
QUESTION 9 (Start on a new page.)

The magnetic field lines between two magnetic poles of a magnet are shown in the diagram below.



9.1 The magnetic force is a non-contact force.

9.1.1 Define the term *non-contact force*. (2)

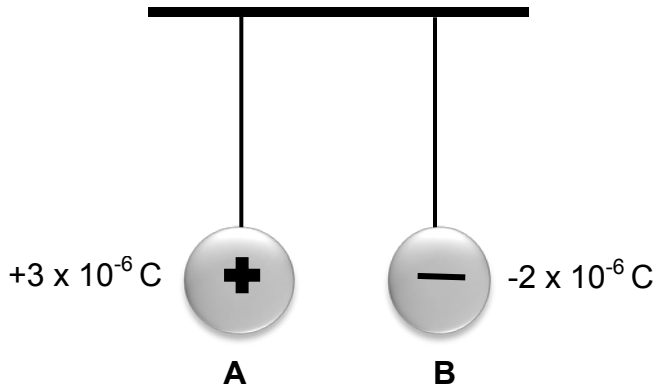
9.1.2 Give another example of a non-contact force. (1)

9.2 What is the nature of the force between the two poles? (1)

9.3 What is the polarity of pole 2? Give a reason for the answer. (2)
[6]

QUESTION 10 (Start on a new page.)

Two small identical spheres, **A** and **B**, are suspended on long silk threads, as shown in the sketch below. The spheres carry charges of $+3 \times 10^{-6}$ C and -2×10^{-6} C respectively.



10.1 Which sphere has an excess of electrons? (1)

10.2 The two spheres are allowed to touch. Will the electrons be transferred from **A to B** or **B to A**? (1)

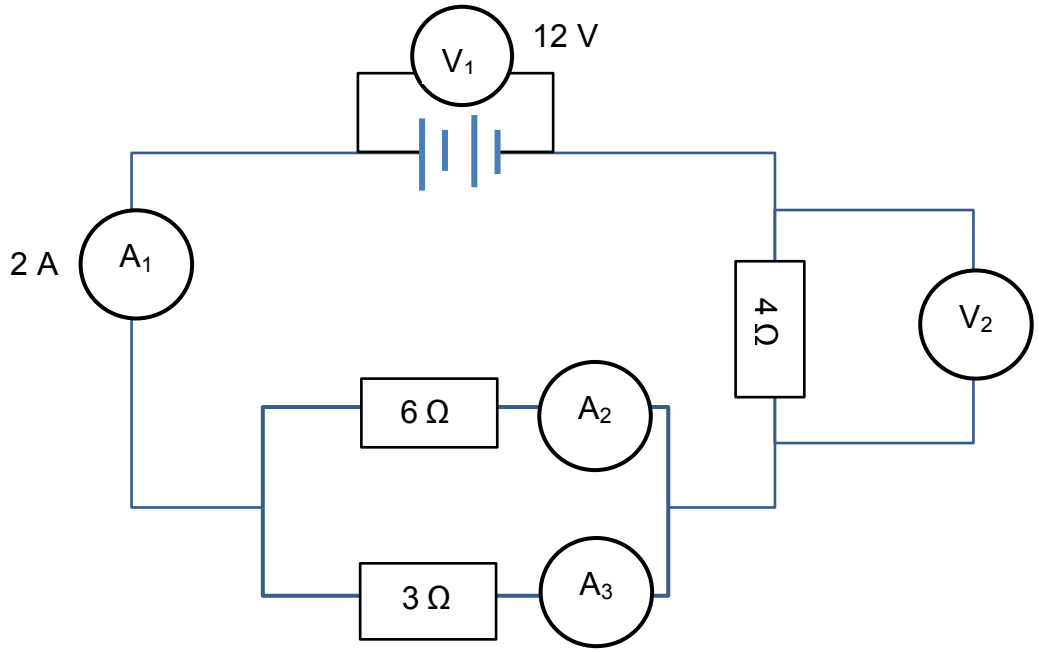
10.3 The spheres are now separated.

Calculate the new charge on sphere **B**. (3)

10.4 Calculate the number of electrons transferred during contact. (3)
[8]

QUESTION 11 (Start on a new page.)

In the circuit diagram below the reading on voltmeter V_1 is 12 V and the reading on ammeter A_1 is 2 A.



11.1 Calculate the:

11.1.1 Total resistance of the circuit (4)

11.1.2 Reading on V_2 (3)

11.1.3 Reading on A_2 (3)

11.1.4 Amount of charge that flows through ammeter A_1 in 120 s (3)

11.2 How will the reading on ammeter A_1 be affected if the 6 Ω resistor is removed from the circuit?

Write down only INCREASE, DECREASE or REMAIN THE SAME. (1)

11.3 Explain the answer to QUESTION 11.2 WITHOUT any calculations. (3)
[17]

TOTAL: 150

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DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
VRAESTEL 1 (FISIKA)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	9,8 $m \cdot s^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3,0 \times 10^{8}$ $m \cdot s^{-1}$
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}$ J·s
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*

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, ENERGIE EN DRYWING*

$U = mgh$ or/*of* $E_P = mgh$	$K = \frac{1}{2}mv^2$ or/*of* $E_k = \frac{1}{2}mv^2$
$E_M = E_k + E_p$. OR $E_M = K + U$	

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

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

ELECTROSTATICS/*ELEKTROSTATIKA*

$n = \frac{Q}{e}$	$Q = \frac{Q_1 + Q_2}{2}$

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$Q = I\,\Delta t$	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + ...$
$R_s = R_1 + R_2 + ...$	$V = \frac{W}{q}$

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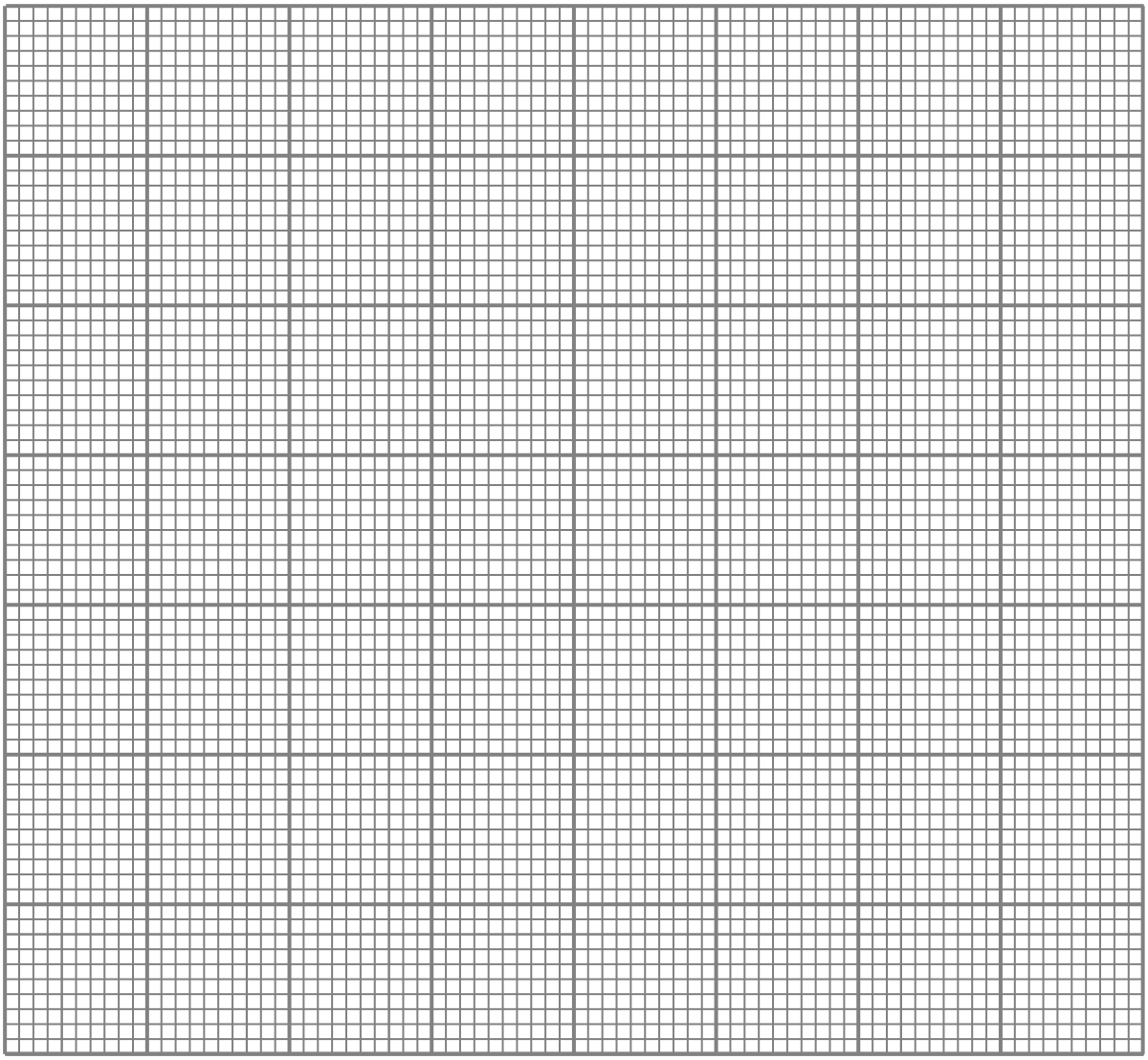
ANSWER SHEET FOR QUESTION 7.3

NAME: _____ CLASS: _____

Hand in this ANSWER SHEET together with the ANSWER BOOK.



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