Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES P1 (PHYSICS)

COMMON TEST

JUNE 2017

NATIONAL SENIOR CERTIFICATE

GRADE 10

MARKS: 100

TIME: 2 hours

This question paper consists of 9 pages and 1 data sheet.

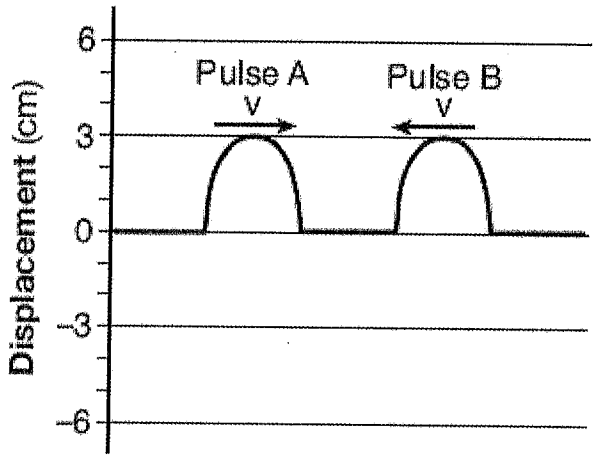
INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate spaces on the ANSWER BOOK.
2. Answer ALL the questions in the ANSWER BOOK.
3. You may use a non-programmable calculator.
4. You may use appropriate mathematical instruments.
5. Number the answers correctly according to the numbering system used in this question paper.
6. You are advised to use the attached data sheets.
7. Give brief motivations, discussions, et cetera where required.
8. Round off your answers to a minimum of 2 decimal places.

QUESTION 1: MULTIPLE CHOICE QUESTIONS

Four possible options are provided as answers to the following questions. Each question has only ONE correct answer. Write ONLY letters (A – D) next to the question number (1.1 – 1.6) in the ANSWER BOOK, e.g. 1.8 C

1.1 The diagram below represents two identical pulses approaching each other in a uniform medium.

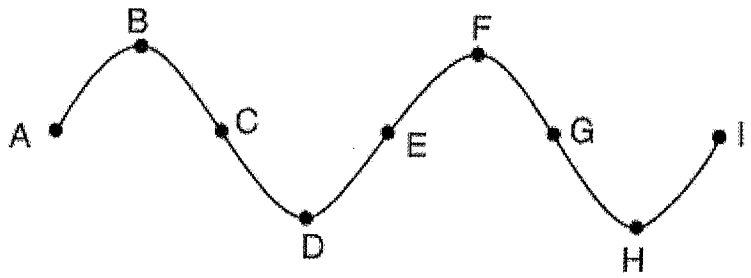


The maximum displacement of the medium when the pulses meet is ...

A -6 cm
B 0 cm
C +3 cm
D +6 cm

(2)

1.2 The diagram below shows a periodic wave moving from left to right.

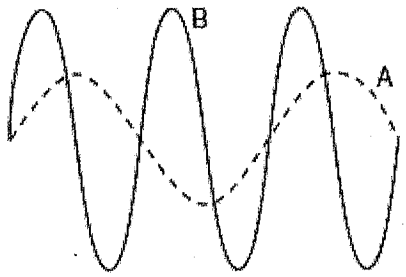


Which TWO points on the wave are 180^0 out of phase?

A F and G.
B D and H.
C B and E.
D A and C.

(2)

1.3 The diagram below shows waves A and B moving in the same medium.



Wave A has an amplitude of **A** and a wavelength equal to **λ.**

Which one of the following combinations is correct for wave B?

	AMPLITUDE	WAVELENGTH
A	A	½ λ
B	2 A	½ λ
C	½ A	λ
D	2 A	2 λ

(2)

1.4 A glass rod acquires a positive charge after it has been rubbed with a silk cloth. Which ONE of the following best explains why this happens?

A negative charges are transferred from the silk cloth to the glass rod.

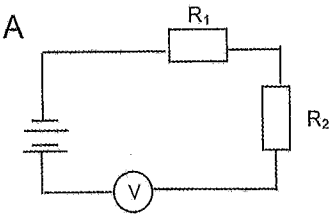
B positive charges are transferred glass rod to the silk cloth.

C negative charges are transferred from the glass rod to the silk cloth.

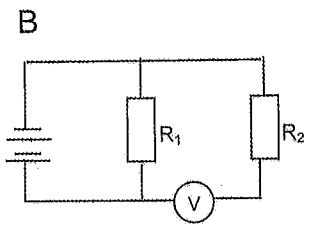
D positive charges are transferred from the silk cloth to the glass rod. (2)

1.5 Which circuit diagram represents voltmeter V connected correctly to measure the potential difference across resistor R_2 ?

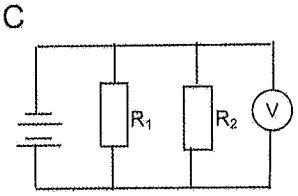
A



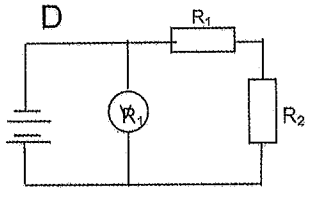
B



C

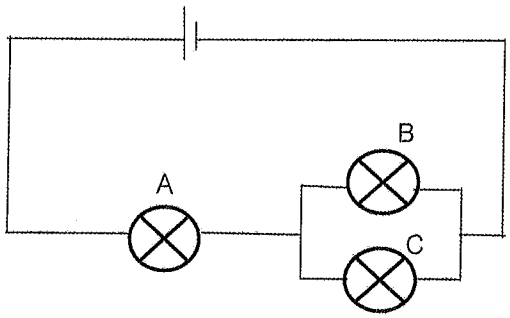


D



(2)

1.6 In the following circuit the bulbs are identical.



Which one of the following statements concerning the brightness of the bulbs is correct?

A. All the bulbs have the same brightness.

B. Bulbs B and C have equal brightness. Bulb A burns brighter than bulb B.

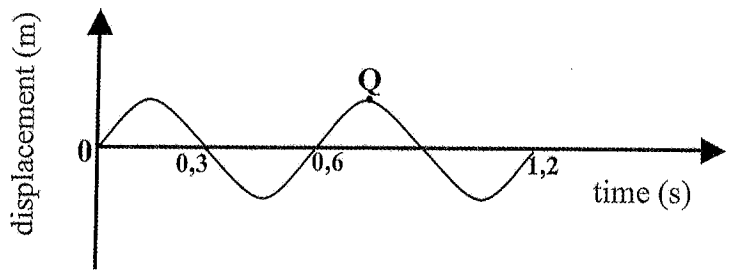
C. Bulbs B and C have equal brightness. Bulb C burns brighter than bulb A.

D. Bulbs B and C have unequal brightness. Bulb A burns brighter than bulb B.

(2)
(6 x 2) = 12

QUESTION 2

2.1 The graph below shows the displacement of a plastic ball on a dam at intervals of 0,3 s after a disturbance has moved through the water at 12 $m \cdot s^{-1}$.



2.1.1 Define a transverse wave. (2)

2.1.2 In what direction is the ball moving at position Q?
(Choose form FORWARDS, UPWARDS or DOWNWARDS). (1)

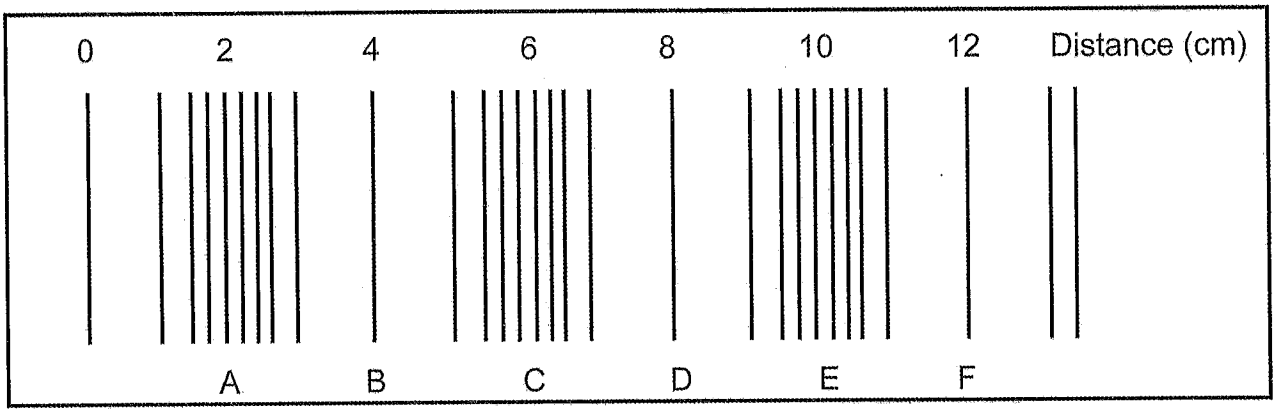
2.1.3 How long will it take for four wave cycles to be completed? (2)

2.1.4 Calculate the frequency of this wave. (3)

2.1.5 Determine the wavelength of this wave. (3)

2.1.6 The speed of the water waves is now doubled. How will this change affect the amplitude of the wave?
(Choose from INCREASES, DECREASES or REMAINS THE SAME). (1)

2.2 The sketch below is a representation of a sound wave produced by a trumpet. The distance travelled by the wave from the source is given in cm. The frequency of the wave is 8500 Hz.



2.2.1 Explain how sound waves are created. (2)

2.2.2 What term is used to describe points C and E? (1)

2.2.3 Calculate the speed of the wave. (4)

2.2.4 What property of sound waves determines the loudness of the sound? (1)
[20]

QUESTION 3

The electromagnetic (EM) spectrum includes, amongst others, radio waves, ultraviolet light, gamma rays, visible light and x-rays.

3.1 Describe how electromagnetic waves are propagated. (2)

3.2 Name the type of electromagnetic radiation that:

3.2.1 Is used to sterilise medical instruments. (1)

3.2.2 Has the longest wavelength. (1)

3.3 State ONE danger of Ultraviolet light. (1)

3.4 Briefly explain what is meant by the DUAL nature of electromagnetic radiation. (2)

3.5 A photon of an electromagnetic wave has a wavelength of 600 nm.

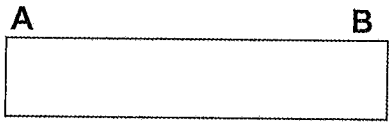
3.5.1 What is a photon? (2)

3.5.2 Calculate the energy associated with this photon. (5)

3.5.3 How will the energy of this photon be affected if its wavelength were to now increase?
(Choose from INCREASES, DECREASES or REMAINS THE SAME). (1)
[15]

QUESTION 4

4.1 In the bar magnet AB, B represents the North pole.

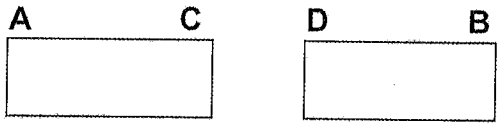


4.1.1 What is a magnetic field? (2)

4.1.2 List three properties of magnetic field lines. (3)

4.1.3 Draw the magnetic field pattern for this magnet. (2)

The bar magnet is now cut in half between A and B, and placed side by side as shown below.



4.1.4 What will be the nature of the force that the two magnets now exert on each other? (Attractive or Repulsive)
Explain fully with reference to the polarity at C and D. (3)

4.2 The magnetic field lines of the Earth look very similar to the field lines of a bar magnet. A compass is used to indicate direction. Like all magnetic fields, the magnetic field of the Earth is caused by moving charges, in this case, charges moving inside the liquid core of the Earth. The magnetosphere is very important to life on Earth because it affects most of the solar winds. South Africa has a permanent base in Antarctica where scientists study the magnetosphere and aurorae.

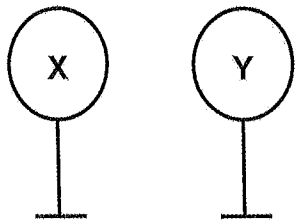
4.2.1 Explain how a compass is used to indicate the direction of the Earth. (2)

4.2.2 What is a solar wind? (2)

4.2.3 How does the Earth's magnetic field protect us from the solar winds? (2)
[16]

QUESTION 5

X and Y are two identical spheres mounted on insulated stands that are placed close to each other.



X carries a charge of + 64 μC and Y is neutral.

5.1 Is the electrostatic force that X exerts on Y attractive or repulsive? Explain fully. (3)

X is now brought into contact with Y for a moment and the spheres are placed back at their original positions.

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

5.3 Which sphere, X or Y, lost electrons when they touched? (1)

5.4 Calculate:

5.4.1 The new charge on each sphere after touching. (2)

5.4.2 The number of electrons transferred when the spheres touched. (3)

5.5 Can a charge of $1,4 \times 10^{-19}$ C exist? (YES or NO). Give a reason. (2)
[13]

QUESTION 6

6.1 State one difference between emf and terminal potential difference? (2)

6.2 Define resistance. (2)

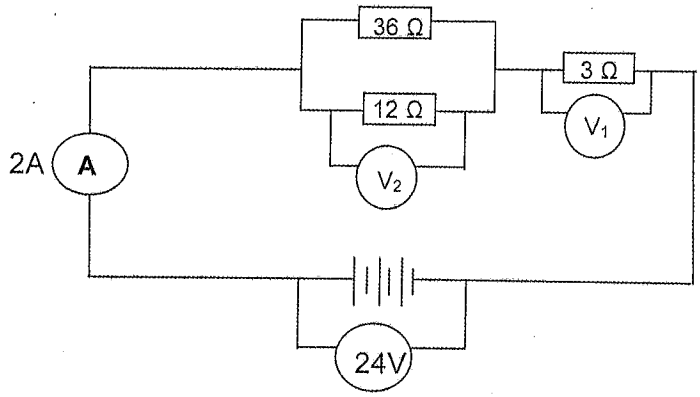
6.3 How will each of the following changes affect the resistance of a conductor? (Choose from INCREASES, DECREASES or REMAINS THE SAME)

6.3.1 Heating the conductor (1)

6.3.2 Increasing the cross-sectional area (thickness) of the conductor. (1)

6.4 Study the following circuit diagram and answer the questions set.

The resistance of the battery and conducting wires may be ignored.



The ammeter reads 2A and V_1 reads 6V.

6.4.1 Calculate the total resistance of the circuit. (5)

6.4.2 Calculate the quantity of charge that flows through the 3 Ω resistor in 2 minutes. (3)

6.4.3 How much electrical work is done by the 3 Ω resistor in 2 minutes? (3)

6.4.4 What is the reading on V_2? (2)

A third resistor is now added in parallel to the 36 Ω resistor. How will this affect each of the following?
(Choose from INCREASES, DECREASES or REMAINS THE SAME).

6.4.5 The reading on the ammeter. Explain the answer. (3)

6.4.6 The emf of the battery. Give a reason. (2)

[24]

TOTAL MARKS: [100]

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*
Speed of light in a vacuum *Spoed van lig in 'n vacuum*	c	$3,0 \times 10^{8}$ m·s^{-1}
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}$ J·s
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}$ kg
Electron charge	q_e	$-1,6 \times 10^{-19}$ C

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

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

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

ELECTROSTATICS

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

ELECTRIC CIRCUIT

$Q = I\ \Delta t$	$\frac{1}{Rp} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$
$R_s = R_1 + R_2 + \ldots$	$V = \frac{W}{Q}$

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PHYSICAL SCIENCES P1 (PHYSICS)

MARKING GUIDELINE

JUNE 2017

NATIONAL SENIOR CERTIFICATE

GRADE 10

MARKS: 100

TIME: 2 hours

This marking guideline consists of 6 pages.

QUESTION 1

1.1 D✓✓
1.2 D✓✓
1.3 B✓✓
1.4 C✓✓
1.5 C✓✓
1.6 B✓✓

[12]

QUESTION 2

2.1.1 Transverse wave is a disturbance that travels at right angles to the medium. ✓✓ (2)

2.1.2 Forwards ✓ (1)

2.1.3 4 x 0,6 s ✓= 2,4 s. ✓ (2)

2.1.4 $f = \frac{1}{T}$ ✓

$= \frac{1}{0,6}$ ✓

=1,67 Hz ✓ (3)

2.1.5 $v = f\lambda$ ✓
$12 = 1,67 \times \lambda$ ✓
$= 7,19\ m{\cdot}s^{-1}$ ✓ (3)

2.1.6 Remains the same. ✓ (1)

2.2.1 Sound waves are created by vibrations in a medium in the direction of propagation. ✓✓ (2)

2.2.2 Compression. ✓ (1)

2.2.3 (6-2) = 4 cm or 0,04 m ✓

$v = f\lambda$ ✓
$v = 8500 \times 0,04$ ✓
$= 340\ m{\cdot}s^{-1}$ ✓ (4)

2.2.4 Amplitude. ✓ (1)

[20]

QUESTION 3

3.1 Electromagnetic waves propagate when an electric field✓ oscillating in one plane produces a magnetic field oscillating in a plane at right angles to it, which produces an oscillating electric field. ✓These mutually generating magnetic and electric fields are propagated through space at right angles to each other as an electromagnetic wave. (2)

3.2.1 gamma rays ✓ (1)

3.2.2 radio waves ✓ (1)

3.3 Sunburn ✓
Skin cancer and other skin conditions (1)

3.4 It means that some aspects of the behaviour of electromagnetic radiation can best be explained using a wave model and some aspects can best be explained using a particle model. ✓✓ (2)

3.5.1 A package of energy in which light travels. ✓✓ (2)

3.5.2 $E = \frac{hc}{\lambda}$ ✓

$= \frac{6{,}63\times10^{-34}\ (\checkmark)\ .\ 3\times10^{8}\ (\checkmark)}{600\times10^{-9}\ (\checkmark)}$

$= 3{,}32\times10^{-19}\ J$ ✓ (5)

3.5.3 Decreases ✓ (1)

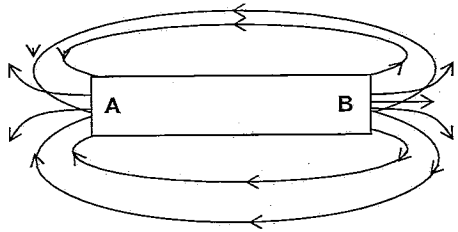
[15]

QUESTION 4

4.1.1 Any region in space where a magnetic substance will experience a (magnetic) force. ✓✓ (2)

4.1.2
- Direction from north to south✓
- They do not intersect. ✓
- Density indicates the strength of the field ✓ (3)

4.1.3



Marking criteria	
Direction of field lines	✓
Shape of the field lines	✓

(2)

4.1.4 Attractive. ✓
Θ
When original magnet is cut in half C becomes south ✓and D becomes north.✓
Unlike poles attract. (3)

4.2.1 A compass is an instrument containing a freely suspended needle comprising a small N-pole. If placed anywhere in the Earth's magnetic field, the needle will indicate the direction called magnetic north ✓✓ (2)

4.2.2 Solar wind is a stream of radioactive and charged particles✓sent into space at high speed. ✓ (2)

4.2.3 The magnetosphere deflects the greater part of the charged particles away from the sun. ✓✓ (2)

[16]

QUESTION 5

5.1 attractive. ✓
Θ
X induces ✓ a negative polarity ✓on Y in the region close to X. (3)

5.2 The total charge in an isolated system remains constant. ✓✓ (2)

5.3 Y ✓ (1)

5.4.1 $\text{new charge} = \frac{Q_X + Q_Y}{2}$

$= \frac{+6{,}4\times10^{-6} + 0}{2}$ ✓

$= +3{,}2\times10^{-6}\ C$ ✓ (2)

5.4.2 $n = \frac{\Delta Q}{Qe}$ ✓

$n = \frac{+3.2 \times 10^{-6} C}{-1,6 \times 10^{-19} C}$ ✓

$= 2 \times 10^{13}$ electrons ✓ (3)

5.5 NO. ✓

Θ The smallest charge that can exist is $1,6 \times 10^{-19} C$ ✓ = charge on the electron. (2)

[13]

QUESTION 6

6.1 Emf : voltage across the battery when no current is flowing. ✓
Terminal potential difference: voltage across the battery when current is flowing. ✓ (2)

6.2 Ratio of p.d. across the conductor to current flowing ✓ ✓
OR
Ability of a conductor to reduce the flow of charge. ✓✓ (2)

6.3.1 increases ✓ (1)

6.3.2 decreases ✓ (1)

6.4.1 $\frac{1}{Rp} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓

$= \frac{1}{36} + \frac{1}{12}$ ✓

$R_p = 9\Omega$ ✓

$R_T = Rp + R_3$

$= 9 + 3$ ✓

$= 12\ \Omega$ ✓ (5)

6.4.2

$Q = I t$ ✓

$= 2 \times 120$ ✓ $= 240$ C ✓ (3)

6.4.3

$W = V Q$ ✓ ✓ $= 6 \times 240$ ✓ $= 1440$ J (3)

6.4.4 18 V ✓✓ (2)

6.4.5 Increase ✓

Θ More resistors in parallel ✓ create more pathways ✓ for current to flow
OR
Resistance of the circuit will decrease. ✓
Current is inversely proportional to resistance ✓ (3)

6.4.6 Remains the same ✓

Θ Emf is constant. ✓ It is the total amount of energy a cell gives to a quantity of charge passing through it. (2)

[24]

TOTAL MARKS: 100