education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES: PHYSICS (P1)

COMMON TEST

JUNE 2019

TIME: 2 hours

MARKS: 100

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

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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. Number the answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two subquestions, for example between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You are advised to use the attached DATA SHEET.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your final answers to a minimum of TWO decimal places.
9. Give brief motivations, discussions, et cetera where required.

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QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four possible responses are provided as 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 – 1.7) in the ANSWER BOOK, for example 1.8 C.

1.1 Particles in phase ...

A need only have the same displacement.
B need only have the same position.
C need only be moving in the same direction.
D must have the same displacement and be moving in the same direction. (2)

1.2 A tuning fork is made to vibrate by striking it gently on a rubber stopper. The sound waves produced are ...

A transverse waves and require a medium for propagation.
B transverse waves and do not require a medium for propagation.
C longitudinal waves and require a medium for propagation.
D longitudinal waves and do not require a medium for propagation. (2)

1.3 Of all the types of electromagnetic rays, gamma rays have the greatest penetrating ability because they have ...

A the longest wavelength.
B a particle nature.
C the highest frequency.
D the highest speed. (2)

1.4 If the north pole of a bar magnet points to the left, what is the direction of the magnetic field between the north and south pole right **above** the magnet?

A To the right
B To the left
C Down
D Up (2)

1.5 A learner has determined the magnitude of the charge on various objects. Which value has most probably been incorrectly calculated?

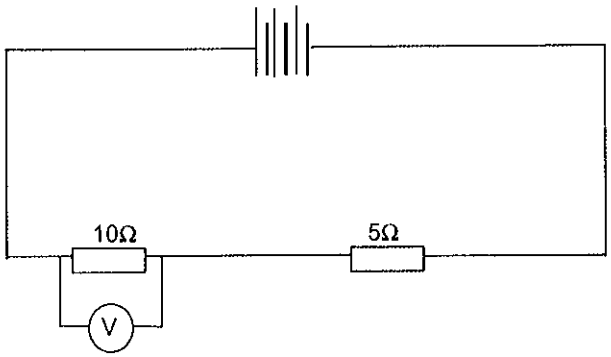
A $9,6 \times 10^{-19}C$
B $6,4 \times 10^{-19}C$
C $4,8 \times 10^{-19}C$
D $4,0 \times 10^{-19}C$ (2)

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1.6 The resistance of a resistor can also be expressed as …

A joule per coulomb.
B volt per ampere.
C joule per second.
D volt per coulomb . (2)

1.7 The voltmeter V reads 4V.



The emf of the battery is therefore …

A 12V

B 8V

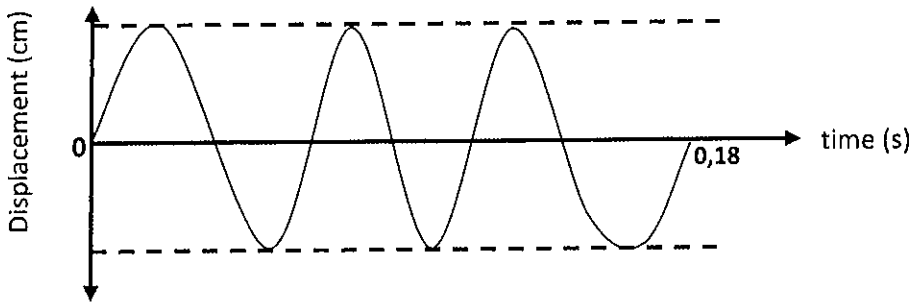
C 6V

D 4V (2)

2 x 7 [14]

QUESTION 2

2.1 A transverse wave is travelling along a string. A point on the medium carrying the wave is observed. A graph of displacement versus time of the point is shown. The distance between two consecutive troughs is 21cm.



2.1.1 Define the term frequency of a wave. (2)

2.1.2 Calculate the frequency of this wave. (3)

2.1.3 Calculate the speed of this wave. (3)

2.1.4 If the wave speed calculated in 2.1.3 is kept constant and the frequency is doubled, what happens to the wavelength? (1)
Choose from HALVED, DOUBLED or REMAINS THE SAME.

2.1.5 Explain your answer to 2.1.4. (3)

2.2 Ships and boats can determine the depth of the water beneath them using an "echo-sounding" method known as ultrasound.

2.2.1 Define the term ultrasound. (2)

2.2.2 A ship transmits a sound wave which is reflected off the seabed. Explain why the reflected sound is **softer** than the original sound. (2)

2.2.3 A ship transmits a sound wave and the echo is heard 3 seconds later. Calculate the depth of the seabed (**in kilometres**) if the speed of the sound in water is 1 510 $m.s^{-1}$. (3)

2.2.4 Name ONE animal that uses ultrasound when navigating through its natural habitat. (1)
[20]

QUESTION 3

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

3.1 List ONE property of all electromagnetic waves. (1)

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

3.3 Radio stations broadcast to listeners by means of electromagnetic radiations called radio waves. Listed below is information about TWO different radio stations:

Radio Station 1 – broadcasts at a frequency of 97,60 MHz
Radio station 2 – has radiations of wavelength 1,50 x 10^3 m

3.3.1 Calculate the energy of a photon associated with radio station 1. (3)

3.3.2 The owner of radio station 2 claims that his transmitter operates at a frequency of 2 MHz. Use a calculation to help explain why his claim is INCORRECT. (4)

3.3.3 How will the energy of a photon transmitted from radio station 2 be affected if its wavelength was decreased? (1)
Choose from INCREASES, DECREASES or REMAINS THE SAME.

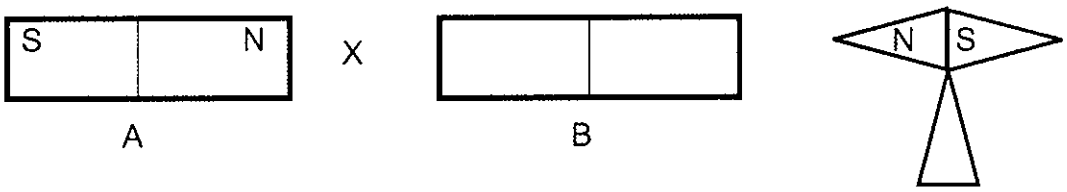
3.3.4 Explain your answer in 3.3.3. (2)
[13]

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QUESTION 4

4.1 Define the term magnetic field. (2)

4.2 The diagram below shows two permanent magnets A and B, as well as a compass placed next to B.



4.2.1 Why would iron be a more suitable material for making the compass needle? (1)

4.2.2 Re-draw magnet B and clearly indicate its magnetic poles. (1)

4.2.3 Is there a force of ATTRACTION or REPULSION between magnets A and B? Explain your answer. (2)

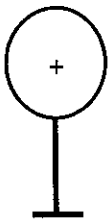
4.2.4 Draw the magnetic field pattern around **region X**, as a result of **both** magnets A and B. (2)

4.3 Define the term magnetosphere. (2)

4.4 Briefly describe how a magnetic storm is caused in the earth's outer magnetosphere. (2)
[12]

QUESTION 5

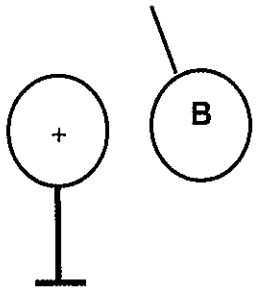
5.1 A glass ball stands on an insulating stand and is made positively charged by rubbing it with a woollen cloth.



5.1.1 Explain the term tribo-electric charging. (2)

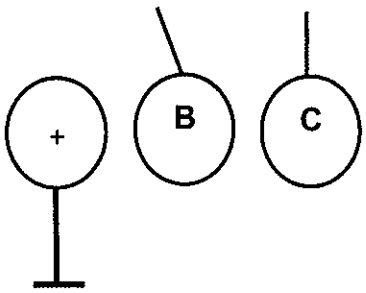
5.1.2 Describe the movement of charge between the glass ball and the woollen cloth. (2)

A learner now hangs a polystyrene ball, marked B, by a thin piece of string near the glass ball.
The polystyrene ball B experiences a force to the right as shown below.



5.1.3 Is ball B POSITIVELY or NEGATIVELY charged? (1)

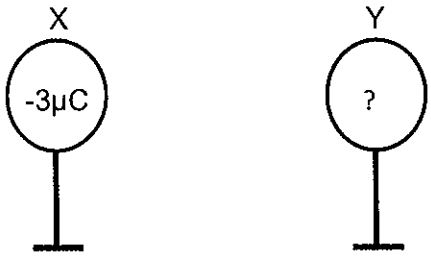
A second uncharged polystyrene ball, marked C, hanging by a thin piece of string, is placed near ball B as shown below.



5.1.4 What happens to ball C? Does it move TO THE LEFT, MOVE TO THE RIGHT or REMAIN STATIONARY? (1)

5.2 X and Y are two identical spheres mounted on insulated stands that are close to each other.
The charge on X is -3μC while the charge on Y is **unknown**.

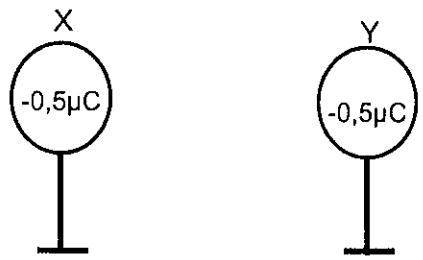
5.2.1 Calculate the number of excess electrons on sphere X. (3)



Before contact

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

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



After contact

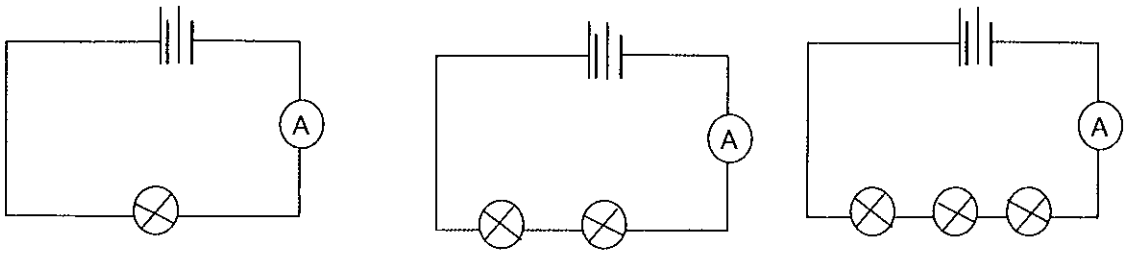
The charge on both X and Y is now -0,5 μC.
Calculate the **original** charge of sphere Y. Show all working. (4)

5.2.4 Did Y LOSE or GAIN electrons? (1)

[16]

QUESTION 6

A learner sets up the following electrical circuits to test a hypothesis.



Circuit 1 Circuit 2 Circuit 3

6.1 State the hypothesis that the learner wants to test. (2)

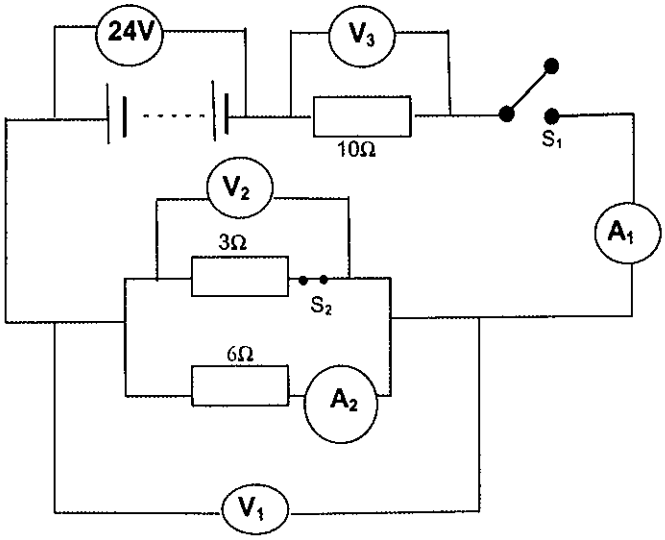
6.2 Identify the dependent variable. (1)

6.3 What energy conversion takes place in all 3 electrical circuits? (2)

[5]

QUESTION 7

A battery is made up of an **unknown** number of cells. Each of the cells in the battery is labelled 3V. The battery is connected in a circuit as shown. Ignore the resistance of the battery and the wires. Initially switch S_1 is open and the voltmeter connected across the ends of the battery reads 24V.



7.1 Does the reading of 24V represent emf or the terminal potential difference? Give a reason for your answer. (2)

7.2 Determine the number of cells in the battery? (1)

When switch S_1 is now closed the ammeter A_1 reads 2A and V_3 reads 20V.

7.3 What will be the reading on:

7.3.1 V_1 (1)

7.3.2 V_2 (1)

7.4 What will the reading on A_2 be if 1,33A of current flows through the 3 Ω resistor? (1)

7.5 How many coulombs of charge flows through A_1 in 1 second? (1)

7.6 Calculate the total resistance in the circuit. (4)

7.7 How long **(in minutes)** will it take 4 800J of electrical energy to flow through the 10 Ω resistor? (5)

7.8 If switch S_2 is now opened (while S_1 remains closed) how will this affect the reading on V_3? Explain. (4)
(Choose from INCREASES, DECREASES or REMAINS THE SAME)

[20]

TOTAL MARKS: [100]

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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*
Speed of light in a vacuum *Spoed van lig in 'n vacuum*	c	$3,0 \times 10^{8}\ m \cdot s^{-1}$
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}\ J \cdot s$
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

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

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PROVINCE OF KWAZULU-NATAL

PHYSICAL SCIENCES P1 (PHYSICS)

COMMON TEST

MARKING GUIDELINE

JUNE 2019

NATIONAL SENIOR CERTIFICATE

GRADE 10

MARKS: **100**

This marking guideline consists of 7 pages.

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QUESTION 1

1.1 D ✓✓ (2)

1.2 C ✓✓ (2)

1.3 C ✓✓ (2)

1.4 A✓✓ (2)

1.5 D✓✓ (2)

1.6 B✓✓ (2)

1.7 C✓✓ (2)

[14]

QUESTION 2

2.1.1 No of complete waves passing a fixed point in one sec.✓✓ (2)

2.1.2

$$f = \frac{1}{T} \quad \checkmark$$

$$= \frac{1}{0,06} \quad \checkmark$$

$$= 16,67\text{Hz} \quad \checkmark$$

OR

3 waves in 0,18 s ✓
x waves in 1 s ✓
f = 16,67 s^{-1} ✓

(3)

2.1.3 **Positive marking from 2.1.2**

V = f x λ ✓
= 16,67 x 0,21 ✓
= 3,50 $m.s^{-1}$ ✓ (3)

2.1.4 Halved ✓ (1)

2.1.5 **Negative Marking from 2.1.4**

- Using v = f x λ ✓
- If frequency is doubled then wavelength must be halved ✓
- In order to keep speed constant ✓ (3)

2.2.1 Sound with a frequency range of between 20 kHz to 100 kHz ✓✓ (2)

2.2.2 Part of the sound energy is absorbed by the sea bed. ✓✓ (2)

2.2.3

$$v = \frac{\Delta x}{\Delta t} \quad \checkmark$$

$$1510 = \frac{\Delta x}{1,5} \quad \checkmark$$

$$\Delta x = 2265\,m$$

$$= 2,27\,km \quad \checkmark$$

(3)

OR

$$v = \frac{\Delta x}{\Delta t} \quad \checkmark$$

$$1510 = \frac{\Delta x}{3} \quad \checkmark$$

$$\Delta x = 4530$$

$$Depth = \frac{4530}{2}$$

$$= 2265\,m$$

$$= 2,27\,km \quad \checkmark$$

2.2.4 Bat ✓ OR Dolphin ✓ (1)
[20]

QUESTION 3

3.1 (ANY ONE)

- Originate from accelerating electric charges ✓
- Propagate as electric and magnetic fields that are perpendicular to each other ✓
- Can travel through a vacuum ✓
- Have a speed of 3 x 10^8 $m.s^{-1}$ ✓ (1)

3.2

- some of its behaviour is explained using a wave model✓
- while other aspects of its behaviour are explained using the particle model.✓ (2)

3.3.1 $E = hf$ ✓
$= (6,63 \times 10^{-34}) \times (97,60 \times 10^{6})$ ✓
$= 6,47 \times 10^{-26} J$ ✓ (3)

3.3.2

OPTION 1

$c = f \times \lambda$ ✓

$3 \times 10^{8} = f \times (1,50 \times 10^{3})$ ✓
$f = 200\ 000 Hz$

$f = 0,20\ MHz$
$\neq 2\ MHz$ } ✓ (4)

OPTION 2

Speed $= f \times \lambda$ ✓
$= 2 \times 10^{6}$ ✓ $\times 1,5 \times 10^{3}$ ✓
$= 3 \times 10^{9} m.s^{-1}$
$\neq 3 \times 10^{8} m.s^{-1}$ } ✓

3.3.3 Increases ✓ (1)

3.3.4 **Negative marking from 3.3.3**

- $E \ \alpha \ \frac{1}{\lambda}$ since (c) remains constant ✓
- When λ decreases then (E) must increase.✓ (2)

[13]

QUESTION 4

4.1 A region in space where a magnet/ferromagnetic material will experience a force ✓✓ (2)

4.2.1 It is ferromagnetic ✓ (1)

4.2.2

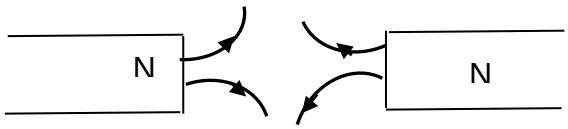
N	**S**

✓ (1)

4.2.3

- Repulsion ✓
- The north pole of A faces the north pole of B ✓ (2)

4.2.4 **Positive marking from 4.2.1**



- Shape ✓
- Direction ✓ (2)

4.3 Region surrounding the earth in which charged particles are trapped. ✓✓ (2)

4.4 Streams of charged particles are given off by solar flares. ✓✓ (2)

[12]

QUESTION 5

5.1.1 Certain materials become electrically charged after they come into contact with different materials. ✓✓ (2)

5.1.2 ● electrons move ✓
● from the glass ball onto the cloth ✓ (2)

5.1.3 Positively charged ✓ (1)

5.1.4 To the left ✓ (1)

5.2.1

$$n = \frac{Q}{Q_e} \quad \checkmark$$

$$= \frac{-3 \times 10^{-6}}{-1,6 \times 10^{-19}} \quad \checkmark$$

$$= 1,88 \times 10^{13} \quad \checkmark$$

(3)

5.2.2 The net charge on an isolated system remains constant ✓✓ (2)

5.2.3

$$Q = \frac{Q_1 + Q_2}{2} \quad \checkmark$$

$$-0,5 = \frac{-3 + Q_y}{2} \quad \checkmark\checkmark$$

$$Qy = +2\mu C \quad \checkmark$$

OR

Total charge = -1 μC ✓
-3 μC ✓+Qy = -1 μC ✓
Qy = 2 μC ✓

(4)

5.2.4 Gain ✓ (1)
[16]

QUESTION 6

6.1 As the number of resistors in series increases so will the current strength decrease ✓✓ (2)

6.2 Current strength ✓ (1)

6.3 Electrical energy converted to light/heat energy ✓✓ (2)
[5]

QUESTION 7

7.1 emf ✓
Since no current is flowing through the battery✓ (2)

7.2 8 ✓ (1)

7.3.1 4V ✓ (1)

7.3.2 4V ✓ (1)

7.4 0,67 A ✓ (1)

7.5 2C ✓ (1)

7.6

$$\frac{1}{Rp} = \frac{1}{R_1} + \frac{1}{R_2} \quad \checkmark$$

$$\frac{1}{Rp} = \frac{1}{3} + \frac{1}{6} \quad \checkmark$$

$$Rp = 2\Omega \quad \checkmark$$

$$R_T = 12\Omega \quad \checkmark$$

(4)

7.7

$V = \frac{W}{Q}$ ✓

$20 = \frac{4800}{C}$ ✓

$Q = 240\ C$

$Q = I\Delta t$ ✓

$240 = 2 \times \Delta t$ ✓

$\Delta t = 120\ s$

$= 2$ minutes ✓

(5)

7.8 **Apply Negative Marking**

- Decreases ✓
- total resistance will increase ✓
- causing total current to decrease ✓
- which causes V_3 to decrease since $V_3 \alpha I$ ✓

(4)
[20]

TOTAL MARKS: 100

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