education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES

PAPER 1

COMMON TEST

MARCH 2020

TIME: 1 Hour

MARKS: 50

This question paper consists of 7 pages and 1 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. This question paper consists of FIVE questions.
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 are advised to use the attached DATA SHEET.
8. Show ALL formulae and substitutions in ALL calculations.
9. Round off your final answers to a minimum of TWO decimal places.
10. 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 – 1.4) in the ANSWER BOOK, for example 1.5 C

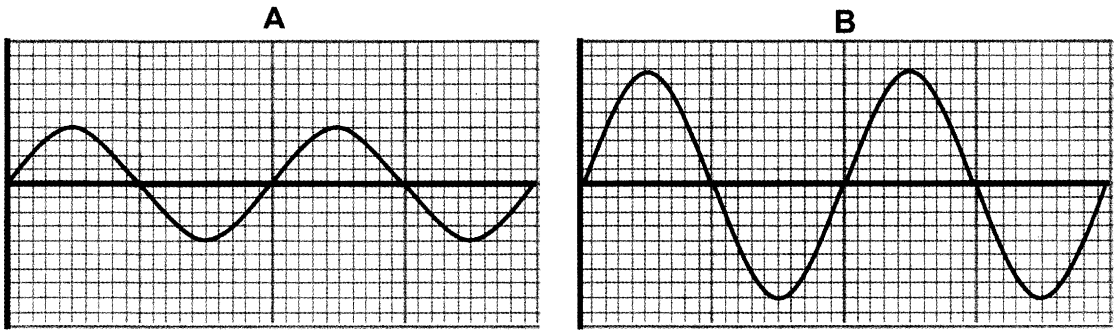
1.1 The distance between any two consecutive points that vibrate in phase on a wave is the …

A period
B wavelength
C amplitude
D frequency (2)

1.2 A wave moves past a fixed point at a speed of x m.s^{-1}. If the speed of the wave stays the same and the frequency of the wave doubles, then the wavelength of the wave will …

A halve
B double
C remain the same
D increase fourfold (2)

1.3 The diagram below represents two sound waves, A and B.



Which ONE of the following combinations that compares the frequency and loudness of A with B is CORRECT?

	Frequency of A	**Loudness of A**
A	Greater than B	Less than B
B	Less than B	Greater than B
C	The same as B	Greater than B
D	The same as B	Less than B

(2)

1.4 Doctors use certain equipment to check on the health of unborn babies. This equipment uses ...

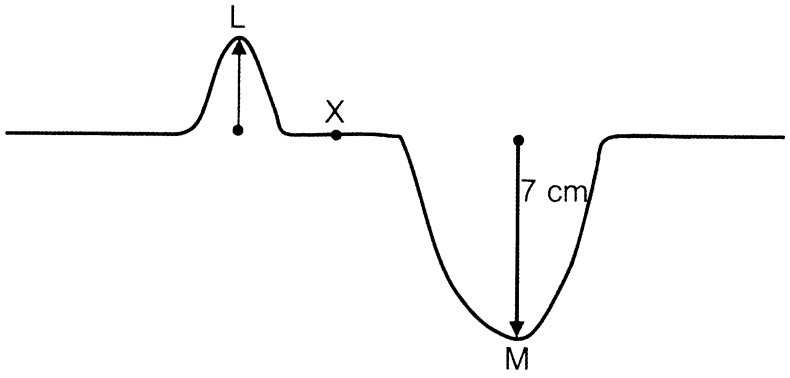
A x-rays
B radio waves
C ultrasound
D microwaves

(2)
[8]

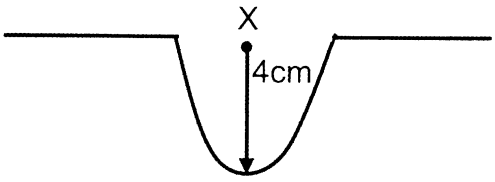
QUESTION 2

2.1 Define the term *pulse.* (2)

2.2 The diagram below shows two pulses L and M, travelling in opposite directions in a rope. The amplitude of pulse L is UNKNOWN and that of pulse M is 7cm.



The two pulses meet at point X and the resulting amplitude is shown below.



2.2.1 What type of interference takes place at X? (1)

2.2.2 Why is it possible to apply the principle of superposition at X? (1)

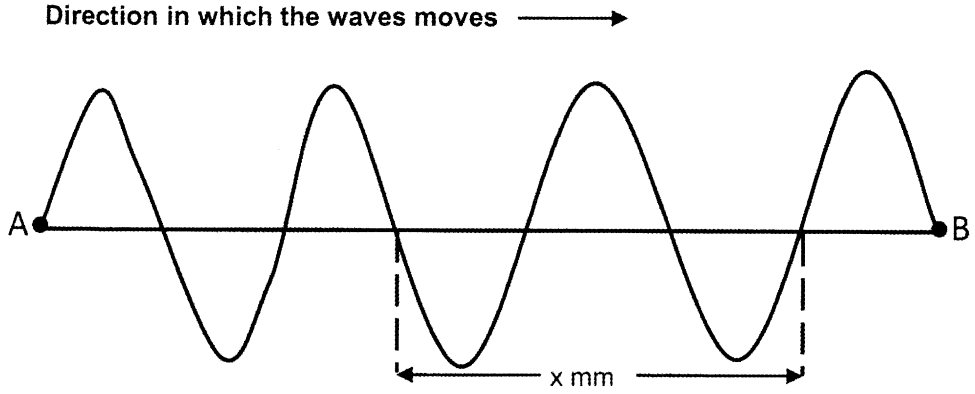
2.2.3 Determine the amplitude of L. (1)

2..2.4 In which direction does pulse M move AFTER the 2 pulses pass each other?
Write either TO THE LEFT or TO THE RIGHT. (1)
[6]

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QUESTION 3

The following wave pattern is produced by a transverse wave that takes 4 seconds to complete one vibration.



3.1 Define the term *transverse wave*. (2)

3.2 Determine the frequency of the wave. (3)

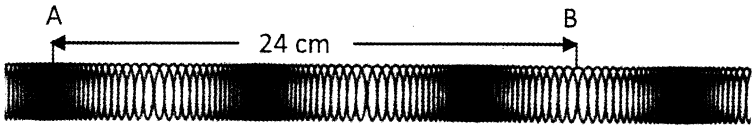
3.3 If the speed of the wave is 0,05 $m.s^{-1}$ calculate the value of x in mm. (5)

3.4 How long (in seconds) does it take for a particle to move from point A to point B? (1)

[11]

QUESTION 4

4.1 A longitudinal wave moves along a slinky spring. Positions A and B are the centres of a compression and a rarefaction respectively. A and B are 24cm apart.



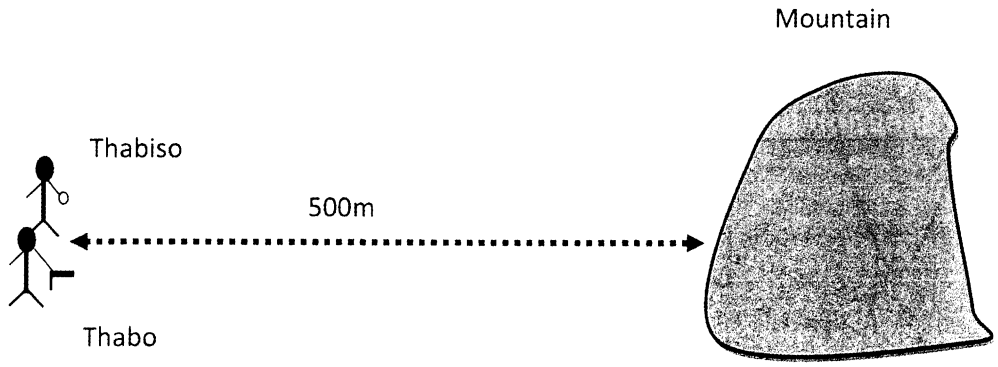
4.1.1 Define the term *compression*. (2)

4.1.2 Use the diagram to determine the wavelength of the wave. (2)

4.1.3 Determine the period of the wave if it takes 1,5s for a particle to move from A to B. (2)

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4.2 Thabo and Thabiso conducted an experiment to determine the speed of sound in air. They stood 500m away from a mountain and Thabo fired a toy gun directly towards the mountain. Thabiso simultaneously started a stop-watch. He then recorded the time taken to hear the echo. The experiment was repeated three times and readings were recorded.



Experiment Number	Time Taken (s)
1	3,01
2	2,95
3	3,04

4.2.1 How is an echo produced? (1)

4.2.2 Determine the average time from the above readings. (1)

4.2.3 Calculate the speed of sound. (2)

4.2.4 How does the speed of sound in water compare to the speed of sound in air?
(Choose from GREATER THAN, LESS THAN or EQUAL TO).
Give a reason. (2)
[12]

QUESTION 5

5.1 What is meant by the term: the DUAL NATURE of electromagnetic radiation? (2)

5.2 A particle has 3,98 x 10^{-13} J of energy and has and a wavelength of 5 x 10^{-13} m.

5.2.1 What is a photon? (2)

5.2.2 What is the speed of a photon? (1)

5.2.3 By means of a calculation, show that the above particle is a photon. (4)

5.3 Will a photon of ultraviolet light have MORE ENERGY or LESS ENERGY than a photon of gamma rays? Give a reason. (2)

5.4 Name the type of electromagnetic radiation that is used to study animals at night. (2)

[13]

TOTAL MARKS: [50]

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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 vacuum*	c	$3{,}0 \times 10^{8}\ m{\cdot}s^{-1}$
Planck's constant *Planck se konstante*	h	$6{,}63 \times 10^{-34}\ J{\cdot}s$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

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

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

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MARKING GUIDELINE

TIME: **1 Hour**

MARKS: **50**

These marking guideline consists of 3 pages.

QUESTION 1

1.1 B ✓✓ (2)

1.2 A ✓✓ (2)

1.3 D ✓✓ (2)

1.4 C ✓✓ (2)

[8]

QUESTION 2

2.1 A single disturbance in a medium ✓✓ (2)

2.2.1 Destructive ✓ (1)

2.2.2 The 2 pulses occupy the same space at the same time ✓ (1)

2.3.1 3 cm ✓ (1)

2.3.2 To the left ✓ (1)

[6]

QUESTION 3

3.1 The particles of the medium vibrate at right angles to the direction of motion of the wave ✓✓ (2)

3.2

$f = \frac{1}{T}$ ✓

$= \frac{1}{4}$ ✓

$= 0{,}25$ Hz ✓

OR

1 wave in 4 s ✓
x waves in 1 s ✓
x = 0,25 waves
f = 0,25 Hz ✓

(3)

3.3 $v = f \times \lambda$ ✓
$0{,}05 = 0{,}25 \times \lambda$ ✓
$\lambda = 0{,}2$ m ✓
x = 200 x 1,5 ✓
= 300 mm ✓ (5)

3.4 14 s ✓ (1)

[11]

QUESTION 4

4.1

4.1.1 A region of high pressure in a longitudinal wave ✓✓ (2)

4.1.2 9,6 cm ✓✓ (2)

4.1.3 1,5s to make 2,5 waves ✓

x s to make 1 wave

x = 0,6 s ✓ (2)

4.2

4.2.1 The sound wave reflects off the hard surface. ✓ (1)

4.2.2 3 s ✓ (1)

4.2.3

$$v = \frac{d}{t}$$
$$= \frac{1000}{3} \checkmark$$
$$= 333{,}33 \ m \cdot s^{-1} \checkmark$$

OR

$$v = \frac{d}{t}$$
$$= \frac{1000}{3} \checkmark$$
$$= 333{,}33 \, m \cdot s^{-1} \checkmark$$

(2)

4.2.4 Greater than ✓
Water is denser than air ✓ (2)

[12]

QUESTION 5

5.1 The radiation has both wave and particle properties ✓✓ (2)

5.2.1 A packet of energy in which light travels. ✓✓ (2)

5.2.2 3×10^8 m.s^{-1} ✓ (1)

5.2.3

$$E = \frac{hc}{\lambda} \checkmark$$
$$3{,}98 \times 10^{-13} \checkmark = \frac{6.63 \times 10^{-34} \times c}{5 \times 10^{-13}} \checkmark$$
$$c = 3 \times 10^8 \, m \cdot s^{-1} \checkmark$$

(4)

5.3 Less energy ✓
Ultraviolet rays have a lower frequency compared to gamma rays✓ (2)

5.4 Infrared ✓✓ (2)

[13]

TOTAL MARKS: [50]

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