Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

NATIONAL
SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES: PHYSICS (P1)

COMMON TEST

MARCH 2018

MARKS: 50

TIME: 1 hour

This question paper consists of 6 pages and 1 data sheet.

INSTRUCTIONS AND INFORMATION

1.   Write your name and class (for example 10A) 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 SHEETS.

7.   Show ALL formulae and substitutions in ALL calculations.

8.   Round off your final answers to a minimum of TWO decimal places.

9.   Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four possible options are provided as answers to the following questions.
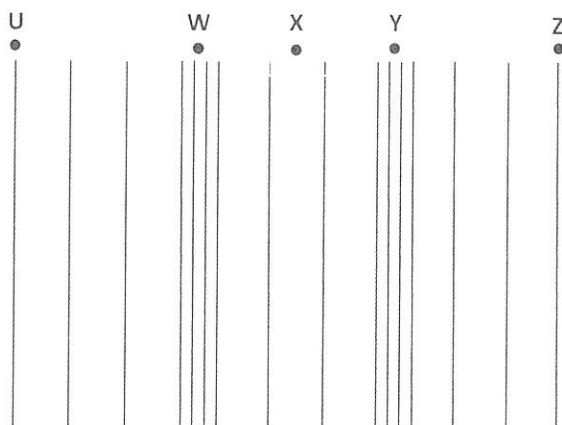Each question has only ONE correct answer. Choose the answer and write only
the letter (A – D) next to the question number (1.1 – 1.4) in the ANSWER BOOK,
for example 1.5 C.

1.1 The time taken for one complete wave cycle to pass a point is known as …

    A   frequency.
    B   amplitude.
    C   wavelength.
    D   period.   (2)

1.2 The diagram below represents a longitudinal wave.

Which one of the following labels correctly indicates a trough?

    A   U
    B   W
    C   Z
    D   X   (2)

1.3   Which type of wave DOES NOT travel at 3×10^8 m.s^{-1}?

       A   Radio
       B   Gamma
       C   Sound
       D   Microwaves   (2)

1.4   Two sound waves, A and B, are travelling through air. Wave A has a
       wavelength of 4,5 m and wave B has a wavelength of 1,5 m. If the
       temperature of the air remains constant as the waves travel, then it can
       be concluded that:

       A   The speed of A is 9 times that of B
       B   The speed of A is 3 times that of B
       C   The speed of A is 1/3 times that of B
       D   Both waves travel at the same speed.   (2)

       [8]

QUESTION 2

Two pulses, A and B, travelling in a medium approach each other. The resulting
amplitude when the two pulses meet at point Q is +2 cm. Pulse B has an amplitude
of +5 cm, and is moving eastwards. The pulse length of both pulse A and B is 4 cm.

2.1   Define a *pulse*.   (2)

2.2   What type of interference takes place at point Q? Give a reason.   (2)

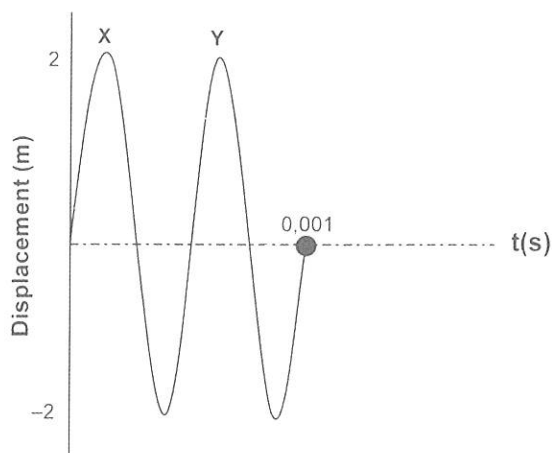2.3   Determine the amplitude of pulse A.   (2)

2.4   Will the pulse length of the resulting pulse at point Q be **EQUAL TO**;
       LESS THAN or **GREATER THAN** 4 cm? Give a reason.   (2)

       [8]

QUESTION 3

Study the following wave form diagram for a wave travelling at 340 m.s^{-1} in air.

3.1 How long does it take for the wave to make one complete wave cycle? (1)

3.2 Define *wavelength*. (2)

3.3 How many wave cycles are there between points X and Y? (1)

3.4 Calculate the frequency of this wave. (2)

3.5 Calculate the wavelength of this wave? (3)

3.6 Copy this wave diagram in your answer book. Label this wave **A**.

    3.6.1 On this same diagram, draw a second wave with a pitch twice that of A and an amplitude that is half of A. Label this wave **B**. Indicate the relevant times for each wave cycle. (3)

    3.6.2 How does the wave length of wave B compare to that of wave A. Use **LONGER THAN**, **EQUAL TO** or **SHORTER THAN**. (1)

                                                           [13]

QUESTION 4

Bats hunt for food by sending out high frequency sound waves. The time taken for the emitted wave to return to the bat enables the bat to determine the distance of the food from it.

4.1   Write down one word for the phrase "reflected sound".   (1)

4.2   A sound wave emitted from a bat strikes a stationary object and returns to the bat after 0,01 s. Calculate how far the object is from the bat.   (4)

4.3   Give a reason why this sound wave produced by the bat can be called ultrasound?   (1)

4.4   How does the speed of sound waves in air compare to the speed in sound waves in water?   (1)

                                                                                                                                           [7]

QUESTION 5

The following are some electromagnetic waves and their corresponding wavelengths:

Electromagnetic Radiation	Wavelength (m)
Wave Z	5×10^{-13}
X-rays	2×10^{-10}
Ultraviolet	3×10^{-7}
Visible light	5×10^{-6}
Infra-red	4×10^{-5}

5.1   Name one source of ultraviolet radiation.   (1)

5.2   Name the radiation that is used to observe objects and people in the absence of light.   (1)

5.3   Which ONE of the above waves has the highest frequency?
        Use the data in the table to explain.   (2)

5.4   Calculate the frequency of ultraviolet light.   (3)

5.5   Define a photon.   (2)

5.6   Calculate the energy of a photon of x-rays.   (4)

5.7   Identify the electromagnetic radiation labelled Z.   (1)

                                                                                                                                          [14]

                                                                                                   TOTAL MARKS: 50

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

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

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

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

GREENBURY

QUESTION 1

1.1   D ✓✓   (2)

1.2   C ✓✓   (2)

1.3   C ✓✓   (2)

1.4   D ✓✓   (2)
              [8]

QUESTION 2

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

2.2   Destructive interference ✓   The resulting pulse is smaller than pulse B ✓   (2)

2.3   –3 cm ✓   (2)

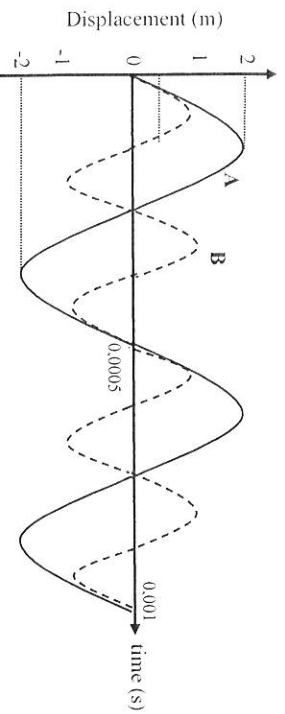2.4   Equal to ✓ only the amplitude of the wave is affected. ✓   (2)
              [8]

QUESTION 3

3.1   3.1.1   T = 5 x 10⁻⁴ s ✓   (1)

      3.1.2   The distance between consecutive points that are in phase ✓   (2)

      3.1.3   One wave cycle ✓   (1)

      3.1.4 $f = \dfrac{1}{T}$ ✓

              $= \dfrac{1}{5 \times 10^{-4}}$

              = 2 000 Hz ✓   (2)

      3.1.5 $v = f . \lambda$ ✓

           340   = (2000) . λ ✓

               λ = 0,17 m ✓   (3)

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MARKING GUIDELINE

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N.B.   This marking guideline consists of 4 pages.

3.6

3.6.1

Displacement (m) — Wave A, Wave B, time (s), 0,0005, 0,001, –1, –2

Marking Criteria for Wave B
1 mark for amplitude of A double that of B
1 mark for two complete cycles of B
1 mark for ending at t = 5 × 10⁻⁴ s OR
1 mark for four complete cycles of B and 1 mark ending at t = 0,001 s (3)

3.6.2   Shorter than ✓ (1)
[13]

QUESTION 4

4.1   Echo ✓ (1)

4.2

$v = \dfrac{d}{t}$ ✓

$d = 345 \times 5 \times 10^{-3}$ ✓✓

$= 1{,}725$ m ✓

OR

$v = \dfrac{d}{t}$ ✓

$d = 345 \times 0{,}01$ ✓

$= 3{,}45$ m ÷ 2 ✓

$= 1{,}725$ m ✓ (4)

4.3   Bats produce high frequency sound waves ✓ or frequency of sound waves range between 20 000 Hz and 100 000 Hz. ✓ (1)

4.4   Sound waves travel faster through water than air. ✓ (1)
[7]

QUESTION 5

5.1   Visible light ✓   **OR**   sun ✓ (1)

5.2   Infrared ✓ (1)

5.3   Wave Z ✓ Wavelength is inversely proportional to frequency. ✓   **OR**   Wave Z has the shortest wavelength. ✓ (2)

5.4 $v = f\lambda$ ✓

$f = \dfrac{3 \times 10^{8}}{3 \times 10^{-7}}$ ✓

$f = 1 \times 10^{15}$ Hz ✓ (3)

5.5   A packet of energy found in light ✓ ✓ (2)

5.6 $E = \dfrac{hc}{\lambda}$ ✓

$E = \dfrac{(6.63 \times 10^{-34})(3 \times 10^{8})}{4 \times 10^{-10}}$ ✓

$= 4{,}9725 \times 10^{-16}$ J ✓ (4)

5.7   Gamma rays ✓ (1)
[14]

TOTAL MARKS: 50