Basic Education

KwaZulu-Natal Department of Basic Education
REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES PHYSICS (P1)
COMMON TEST
MARCH 2016

NATIONAL SENIOR CERTIFICATE

GRADE 10

TIME: 1 hour

MARKS: 50

This question paper consists of 7 pages including 1data 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.   Round off your final numerical answers to a minimum of TWO decimal places

8.   Give brief motivations, discussions, etcetera where required

QUESTION 1: MULTIPLE CHOICE

Four possible options are provided as answers. Choose the correct option by writing only the letter next to the question number (1.1 – 1.5).

1.1   If a note played on a piano has the same pitch as the one played on a guitar, the two notes will have the same:

     A   Amplitude

     B   Loudness

     C   Quality

     D   Frequency   (2)

1.2   The time required for a wave to complete one full cycle is called

     A   frequency

     B   velocity

     C   period

     D   wavelength   (2)

1.3   If the velocity of the wave remains constant, which one of the following increases when the wavelength decreases?

     A   Frequency

     B   Amplitude

     C   Speed

     D   Period   (2)

           [6]

QUESTION 2

The graph below, not drawn to scale, represents two waves, **A** and **B**, of the same wavelength but different amplitudes, crossing each other.
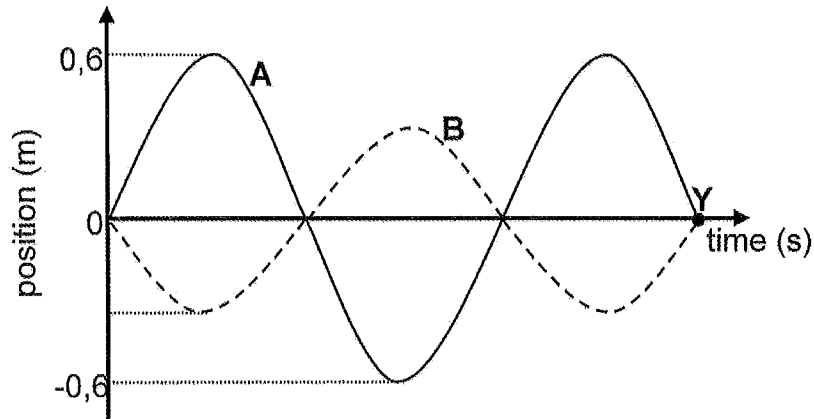
2.1	Are the two waves transverse or longitudinal waves?	(1)
2. 2	State the *principle of superposition of waves.*	(2)
2. 3	The amplitude of wave B is two thirds ($\frac{2}{3}$) the amplitude of wave A. Calculate the amplitude of wave B.	(2)
2. 4	Points P and Q are points on the waves. Label each point.	(2)
2. 5	Draw the shape of the resulting wave as the two waves (**A** and **B**) meet. On your diagram, show the resulting amplitude.	(3)
2. 6	What type of interference is this?	(2)
2. 7	Wave **A** travels a distance of 0,6 m from point O to point Y in 0,015 s. Calculate:	
	2.7.1 the speed of this wave	(3)
	2.7.2 the frequency of this wave.	(2)

[17]

QUESTION 3

3.   Sipho and his friend Kadesh decide to do an investigation on the speed of
        sound. Sipho holds a drum 10 m from a wall while Kadesh stands some
        distance away holding a sound detector in his hand.
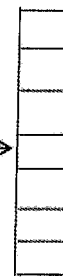   When Sipho hits the drum ONCE the sound detector receives TWO sounds.

Kadesh   Sipho

                                                        wall
                            ←——— 10 m ———→

3.1   Explain why the detector receives two sounds.   (2)

3.2   The second sound reached the detector 0,15 s after Sipho hits the drum.
        Calculate the distance between Sipho and Kadesh.   (4)

3.3   What will be the result if Sipho hits the drum in a vacuum?
        Give a reason for your answer.   (2)

                                                                               [8]

QUESTION 4

One of the types of electromagnetic radiation is ultraviolet light. Sunlight is a major
source of ultraviolet light.

4.1   How is an electromagnetic wave created?   (2)

4.2   Name three other types of electromagnetic waves that have a frequency
        lower than that of ultraviolet light.
        Arrange these waves in order of INCREASING frequency.   (4)

4.3   The over exposure to the ultraviolet light could have harmful effects on humans.

        State ONE of these harmful effects on humans.   (1)

4.4   Doctors use ultraviolet light to clean their surgical equipment.

        Explain how this is possible by referring to the properties of ultraviolet light.   (2)

        Ultraviolet light of frequency $1,5 \times 10^{15}$ Hz was used to shine on a metal surface in order to remove electrons.

4.5   Define a photon.   (2)

4.6   Calculate the energy of a photon of this ultraviolet light.   (3)

4.7   Calculate the wavelength of this light.   ( )

4.8   The electromagnetic waves are transverse waves and sound waves are longitudinal waves. State two other differences between these waves.   (2)

                                                                                         [19]

                                                        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
Acceleration due to gravity Swaartekragversnelling	g	$9{,}8 \ \text{m·s}^{-2}$
Speed of light in a vacuum Spoed van lig in 'n vacuum	c	$3{,}0 \times 10^{8} \ \text{m·s}^{-1}$
Planck's constant Planck se konstante	h	$6{,}63 \times 10^{-34} \ \text{J·s}$
Electron mass Elektronmassa	m_e	$9{,}11 \times 10^{-31} \ \text{kg}$

TABLE 2: FORMULAE/TABEL 2: FORMULES

MOTION/BEWEGING

$v_f = v_i + a\,\Delta t$	$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ or/of $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$v_f^2 = v_i^2 + 2a\Delta x$ or/of $v_f^2 = v_i^2 + 2a\Delta y$	$\Delta x = \left(\dfrac{v_f + v_i}{2}\right)\Delta t$ or/of $\Delta y = \left(\dfrac{v_f + v_i}{2}\right)\Delta t$

FORCE/KRAG

$F_{net} = ma$	$p = mv$
$F\Delta t = \Delta p = mv_f - mv_i$	$F_g = mg$

WORK, ENERGY AND POWER/ARBEID, ENERGIE EN DRYWING

$W = F\Delta x \cos\theta$	$U = E_p = mgh$
$K = E_k = \dfrac{1}{2}mv^2$	$W = \Delta K = \Delta E_k = E_{kf} - E_{ki}$
$P = \dfrac{W}{\Delta t}$	$P = Fv$

WAVES, SOUND AND LIGHT/GOLWE, KLANK EN LIG

$v = f\lambda$ or/of $v = \nu\lambda$	$T = \dfrac{1}{f}$ or/of $T = \dfrac{1}{\nu}$
$f_L = \dfrac{v \pm v_L}{v \pm v_s} f_s$	$E = hf$ or/of $E = h\nu$ or/of $E = h\dfrac{c}{\lambda}$
$\lambda = \dfrac{h}{mv}$	$\sin\theta = \dfrac{m\lambda}{a}$
$hf = W_0 + \dfrac{1}{2}mv^2 = hf_0 + \dfrac{1}{2}mv^2$	

SECTION A

QUESTION 1

1.1 D ✓✓ (2)

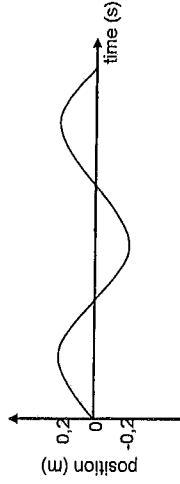1.2 C ✓✓ (2)

1.3 A ✓✓ (2)

[6]

QUESTION 2

2.1 transverse ✓ (1)

2.2 When two or more waves of the same type meet at a point, ✓ the resultant displacement of the waves is equal to the vector sum of their individual displacements at that point. ✓ (2)

2.3 Wave B = 2/3 X 0,6 ✓
= 0,4 m ✓ (2)

2.4 P = crest ✓
Q = trough ✓ (2)

2.5 (2)

position (m) / time (s) graph with values 0,2 / 0 / -0,2

Criteria for diagram:
- Diagram shows 1½ waves with shape as shown. ✓
- Amplitude correctly shown as 0,2 m. ✓✓

2.6 Destructive ✓ interference ✓ (2)

2.7.1
$v = \dfrac{\Delta x}{\Delta t}$ ✓
$= \dfrac{0,6}{0,015}$ ✓
∴ v = 40 m·s⁻¹ ✓ (3)

(3)

(3)

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(PHYSICS)

MEMORANDUM

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N.B. This memorandum consists of 4 pages.

2.7.2 $f = \dfrac{1,5}{0,015}$ ✓ $= 100Hz$ ✓ (2)

[17]

QUESTION 3

3.1 The first is the sound wave traveling directly to him. ✓ The second is the sound wave reflected from the wall. ✓ (2)

3.2 $v = \dfrac{\Delta x}{\Delta t}$ ✓

$340 = \dfrac{\Delta x}{0,15}$ ✓ $=51cm$

Distance $= 51 – 10 = 41 \, m$ ✓ (4)

3.3 No sound. ✓ Sound waves need a medium to travel. ✓ (2)

[8]

QUESTION 4

4.1 accelerating charge ✓ in a magnetic field✓ (2)

4.2 radio, microwaves, infrared, visible ✓✓✓(any three) + arrangement✓) (4)

4.3 Any ONE: ✓
-Damage to skin. /Causes (skin) cancer.
-Damage to eyes. /Increased occurrence of cataracts.
-Damage to crops resulting in food shortages. (1)

4.4 the wave has high energy ✓/ high frequency wave which can penetrate microorganisms and kill them off.✓ (2)

4.5 Photon is the energy 'packet' of light ✓✓ (2)

4.6 $E = hf$ ✓
$= (6,63 \times 10^{-34})(1,5 \times 10^{15})$ ✓
$= 9,95 \times 10^{-19} \, J$ ✓ (3)

4.7 $c = f\lambda$ ✓
$3 \times 10^{8} = (1,5 \times 10^{15}) \, \lambda$✓
$\lambda = 200 \times 10^{-9} \, m$ ✓ (3)

4.8

EM waves	Sound
can travel through vacuum/ Does not need a medium✓	Cannot travel through vacuum/ needs a medium✓
Speed $= 3 \times 10^{8} \, m \cdot s^{-1}$	Speed $= 340 \, m.s^{-1}$ ✓

(2)

[19]

TOTAL = [50]