



**NAMIBIA UNIVERSITY  
OF SCIENCE AND TECHNOLOGY**

**FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES**

**DEPARTMENT OF NATURAL AND APPLIED SCIENCES**

<b>QUALIFICATION : BACHELOR OF SCIENCE</b>	
<b>QUALIFICATION CODE: 07BOSC</b>	<b>LEVEL: 5</b>
<b>COURSE: GENERAL PHYSICS 1B</b>	<b>COURSE CODE: GNP502S</b>
<b>SESSION: JANUARY 2023</b>	<b>PAPER: THEORY</b>
<b>DURATION: 3 Hours</b>	<b>MARKS: 100</b>

<b>SUPPLEMENTARY/SECOND OPPORTUNITY EXAMINATION QUESTION PAPER</b>	
<b>EXAMINER(S)</b>	<b>PROF ONJEFU SYLVANUS</b>
<b>MODERATOR:</b>	<b>PROF DIPTI SAHU</b>

PERMISSIBLE MATERIALS  
Non-programmable Calculator

**THIS QUESTION PAPER CONSISTS OF 6 PAGES**

(Including this front page)

**SECTION A**

**QUESTION 1**

**[40 MARKS]**

**Suggested Question Types: Multiple Choice/Objectives**

**Each question in this section carries two marks**

- 1.1 The period of a wave is 0.02 seconds. Calculate its wavelength if its speed is 330 m/s. (2)
- a. 6.6 m    b. 5.0 m    c. 4.0 m    d. 2.0 m
- 1.2 What is the frequency of a radio wave of wavelength 150 cm if the velocity of radio waves in free space is  $3 \times 10^8$  m/s? (2)
- a.  $4.5 \times 10^{10}$     b.  $5.0 \times 10^9$     c.  $2.0 \times 10^6$     d.  $2.0 \times 10^7$
- 1.3 The maximum displacement of a wave from its rest position is called what? (2)
- a. Frequency    b. Amplitude    c. Trough    d. Vibration
- 1.4 What is the refractive index of a substance if the real depth is 6 m and its apparent depth is 4.5 m? (2)
- a. 10.5    b. 1.33    c. 1.50    d. 0.75
- 1.5 One cycle of a wave takes 0.1 s to pass a stationary observer. What is the frequency of the wave? (2)
- a. 0.1 Hz    b. 0.2 Hz    c. 10 Hz    d. 20 Hz
- 1.6 What is the speed of the wave in Question 1.5, if its wavelength is 20 cm? (2)
- a. 200 m/s    b. 2 cm/s    c. 2 m/s    d. 20 m/s
- 1.7 An object with a height of 1.00 cm is placed 10.0 cm from a concave mirror whose radius of curvature is 30.0 cm. Determine the position of the image. (2)
- a. 30 cm    b. -30 cm    c. 20 cm    d. -20 cm
- 1.8 To what level is the image in Question 1.7 magnified? (2)
- a. +3.0    b. +2.0    c. +4.0    d. +5.0
- 1.9 In the dispersion of white light into its component colors, ..... is the least bent. (2)
- a. Violet    b. blue    c. green    d. red

1.10 ..... has the shortest wavelength when a triangular prism spreads white light out into its component colors. (2)

- a. Yellow   b. indigo   c. orange   d. violet

1.11 Which of the following is not a mechanical wave? (2)

- a. Wave propagated in stretched string      b. Waves in closed pipe  
c. Radio waves                                      d. water wave

1.12 Wave tend to spread out or bend in when they pass an edge or through a gap. This bending effect is called what? (2)

- a. dispersion   b. diffraction   c. superposition   d. interference

1.13 The focusing of different colours of light at different distances behind a lens is known as what? (2)

- a. myopia   b. hyperopia   c. astigmatism   d. chromatic aberration

1.14 The whistle of a train emits a tone of frequency 440 Hz as the train Approaches a stationary observer at 30 m/s. What frequency does the observer hear? [Speed of wave is 331 m/s]. (2)

- a. 380 Hz   b. 483 Hz   c. 485 Hz   d. 484 Hz

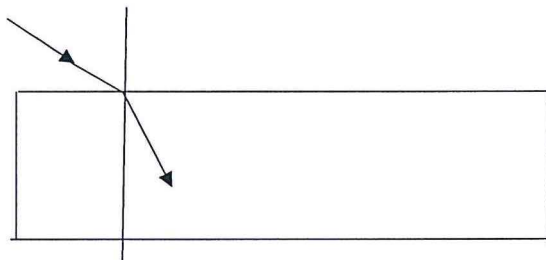
1.15 ..... is the characteristic of a note which enables us to differentiate a high note from a low note. (2)

- a. Intensity   b. node   c. pitch   d. loudness

1.16 A normal human ear can respond to ..... frequency range. (2)

- a. 20 Hz to 20,000 Hz   b. 20,000 Hz to 20, 000000 Hz   c. below 20 Hz  
d. above 20,000 Hz

1.17 A ray of light is incident on a body X as shown in the diagram. What is the refractive index of the body? (2)



- a. 0.58   b. 1.63   c. 1.50   d. 1.33

1.18 If the angle of incidence for light travelling from air to glass is  $45^\circ$  and the angle of refraction in the glass is  $28^\circ$ , determine the refractive index of glass with respect to air. (2)

- a. 1.51   b. 0.66   c. 1.62   d. 2.25

1.19 What is the critical angle for light travelling from water to air? [Take  ${}_a n_w = \frac{4}{3}$ ]. (2)

- a.  $0.75^\circ 1'$    b.  $48^\circ 36'$    c.  $28^\circ 40'$    d.  $25^\circ 17'$

1.20 The mirage is a phenomenon of ..... (2)

- a. Interference   b. total internal reflection   c. dispersion  
d. diffraction

**SECTION B**

**[60 MARKS]**

**QUESTION 2**

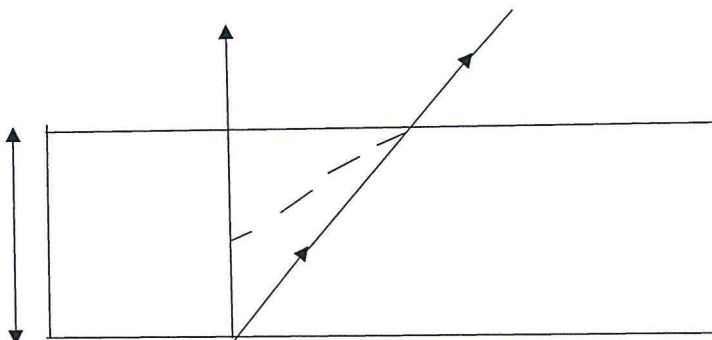
**[16 MARKS]**

2.1 Explain with the aid of a diagram how a converging lens could be used to

2.1.1 ignite a piece of carbon paper (3)

2.1.2 Produce an enlarged picture on a screen (3)

2.2 Calculate the refractive index of the material of the glass block shown in the Diagram if  $YX = 4$  cm. (2)



2.3 State the two condition that must be fulfilled for total internal reflection to occur. (4)

2.4 A thin glass lens ( $n = 1.5$ ) has a focal length of + 10 cm in air. Compute its focal length in water ( $n = 1.33$ ). (4)

**QUESTION 3**

**[15 MARKS]**

3.1 Differentiate between chromatic aberration and spherical aberration and give one example for each of their correction. (6)

3.2 Explain and illustrate schematically a constructive interference. (4)

3.3 Light of wavelength 750 nm passes through a slit  $1.0 \times 10^{-3}$  mm wide. How wide is the central maximum on a screen 20 cm away? (5)

**QUESTION 4**

**[14 MARKS]**

4.1 State doppler effect in sound. (2)

4.2 An automobile moving at 30.0 m/s is approaching a factory whistle that has a frequency of 500 Hz.

4.2.1 If the speed of sound in air is 340 m/s, what is the apparent frequency of the whistle as heard by the driver? (3)

4.2.2 Repeat for the case of a car leaving the factory at the same speed. (3)

4.3 When two tuning forks are sounded simultaneously, they produce one beat every 0.30 seconds.

4.3.1 By how much their frequency differ if the number of beats per second equal the frequency difference. (3)

4.3.2 A tiny piece of chewing gum is placed on a prong of one fork. Now there is one beat every 0.40 seconds. Was this turning fork lower- or the higher frequency fork? (3)

**QUESTION 5**

**[15 MARKS]**

5.1 Describe an experiment and show how the fundamental frequency of a closed pipe is obtained. (4)

5.2 The length of air column at which the first resonance was observed, when a vibrating fork was placed on a resonance tube, was 30 cm. Determine the wavelength of the air column and the frequency of the fork. [Take speed of sound as 330 m/s] (4)

5.3 Compute the speed of sound in neon gas at 27°C. For neon,  $M = 20.18 \text{ kg/kmol}$ . [Take the ratio of the specific heat  $\gamma$ , for monoatomic gas as 1.67,  $R = \text{gas constant} = 8314 \text{ J/Kmol.K}$ ]. (3)

5.4 Find the speed of sound in a diatomic ideal gas that has a density of  $3.50 \text{ kg/m}^3$  and a pressure of 215 kPa. [Using the equations of gas law  $PV = (m/M)RT$ ; ratio of specific heat capacity,  $\gamma = 1.40$  for a diatomic ideal gas]. (4)

**END**