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QUALIFICATION : **BACHELOR OF SCIENCE**	
QUALIFICATION CODE: **07BOSC**	LEVEL: **5**
COURSE: **GENERAL PHYSICS 1B**	COURSE CODE: **GNP502S**
DATE: **NOVEMBER 2024**	SESSION: **1**
DURATION: **3 HOURS**	MARKS: **100**

FIRST OPPORTUNITY: EXAMINATION QUESTION PAPER

EXAMINER: **PROF SYLVANUS ONJEFU**
MR MARKUS HITILA

MODERATOR: **PROF DIPTI SAHU**

INSTRUCTIONS:

1. Answer all questions on the separate answer sheet.
2. Please write neatly and legibly.
3. Do not use the left-side margin of the exam paper. This must be allowed for the examiner.
4. No books, notes and other additional aids are allowed.
5. Mark all answers clearly with their respective question numbers.

PERMISSIBLE MATERIALS

1. Non-Programmable Calculator

ATTACHMENTS

1. None

This paper consists of 6 pages including the front page

SECTION A

QUESTION 1 [40 MARKS]

Suggested Question Types: Multiple Choice/Objectives

Each question in this section carries two marks

1.1 Doppler effect is as a result of. (2)

a. reflection b. relative motion c. rarefaction d. beat effect

1.2 If the length of the air column in a closed pipe is 45 cm when it emits its First overtone, the wavelength of the note produce is: (2)

a. 180 cm b. 90 cm c. 60 cm d. 45 cm

1.3 A man standing 99 m from the foot of a tall cliff claps his hands and hears an echo 0.6 s later. Calculate the velocity of the sound in air in ms^{-1}. (2)

a. 330 b. 59.4 c. 82.5 d. 430

1.4 A beam of polarized light is one constrained to vibrate in a ..... plane perpendicular to the beam. (2)

a. multiple b. triple c. single d. quadruplet

1.5 In which of the following is the speed of sound greatest? (2)

a. air at 100°C b. water c. wood d. steel

1.6 The change of direction of wave front because of a change in the velocity of the wave in another medium is called what? (2)

a. Polarization b. interference c. diffraction d. refraction

1.7 A radio station broadcasts at a frequency of 300 kHz. If the speed of the wave Is 3×10^{8} ms^{-1}, calculate the period and wavelength of the wave. (2)

a. 3.3×10^{6} m b. 3.3×10^{-6} m c. 1×10^{3} m d. 1×10^{-3} m

1.8 Which of the following statements about images formed by a plane mirror is false? It is; (2)

a. The same size as the object b. virtual c. enlarged d. lateral inverted

1.9 The combination of two overlapping waves is called what? (2)

a. aggregate b. superposition c. dispersion d. wavelength

1.10 Suppose the real depth of a pond is 6 m and its apparent depth is 4.5 m. The refractive index of the water of the pond is given by? (2)

a. 1.35 b. 1.36 c. 1.47 d. 1.33

1.11 A hunter at a distance x from a cliff fires a gun. He hears the echo from the cliff after 2.4 seconds. If the speed of sound in air is 340 m/s, determine x. (2)

a. 408 m b. 209 m c. 100 m d. 501 m

1.12 Transverse and longitudinal waves travelling in the same direction in a Medium differ essentially in their (2)

a. Direction of vibration of the particles of the medium b. Wavelength

c. Amplitude d. Frequency

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

a. Radio wave b. sound wave c. water wave d. wave in a closed pipe

1.14 ..... image cannot be projected on a screen. (2)

a. real b. virtual c. critical d. principal

1.15 A light ray of wavelength 589 nm traveling through air strikes a smooth, flat slab of crown glass at an angle of 30^0 to the normal. Determine the angle of refraction. (2)

a. 18.2^0 b. 20.1^0 c. 17.2^0 d. 19.2^0

1.16 A type of aberration in which the wavelength is dependent on refraction is called what? (2)

a. spherical aberration b. chromatic aberration
c. cubical aberration d. sita aberration

1.17 The combination of rays gives rise to .....? (2)

a. beam b. radiation c. particles d. incident rays

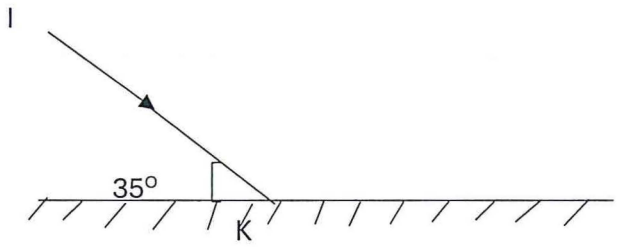
1.18 Light reflecting off a flat mirror creates an image that appears to be ..... the mirror. (2)

a. infront b. behind c. lateral d. tangential

1.19 ..... Is a device that transforms energy into a beam of coherent monochromatic light. (2)

a. lasers b. slit order c. path difference d. diffraction gating

1.20 The diagram below shows a ray of light IK incident on plane mirror at K. Calculate the angle of deviation of the ray after reflection. (2)



a. 35° b. 70° c. 55° d. 90°

SECTION B

QUESTION 2 [16 MARKS]

2.1 A plane progressive wave is represented by the equation, $y = 0.3\sin\left(200\pi t - 20\pi\frac{x}{18}\right)$. Find the

2.1.1 Frequency of the wave. (4)
2.1.2 Wavelength. (4)
2.1.3 Its speed. (4)

2.1 An object is placed in front of a converging lens of focal length 20 cm. The image is virtual and has a magnification of 2. What is the distance of the object from the lens? (4)

QUESTION 3 [14 MARKS]

3.1 If u is the object distance and v is the image distance, show that the magnification M is given by; $M = \frac{v}{u} = \frac{v}{f} - 1$. (5)

3.2 An object is 0.5 ft in front of a concave mirror, and the image is located 2.0 ft behind the mirror. Find the focal length and the radius of curvature of the mirror. (5)

3.3 The velocity of light in air and glass are 3×10^8 m/s and 1.8×10^8 m/s respectively. Calculate the sine of the angle of incidence that will produce and angle of refraction of 30^o for a ray of light incident on glass. (4)

QUESTION 4 [16 MARKS]

4.1 Illustrate with the aid of a diagram destructive interference. (3)

4.2 The distance between the two slits is 0.030 mm. The second-order bright fringe is measured on a viewing screen at an angle of 2.15^o from the central maximum. Evaluate the wavelength of the light in nano meter (4)

4.3 What is meant by 'a beam of polarized light? (2)

4.4 With the aid of well labelled diagrams, illustrate the action of a Polaroid on beam of sunlight. (4)

4.5 List three crystals that serve as light polarizing filters. (3)

QUESTION 5 [14 MARKS]

5.1 A train is moving toward an observer with a speed of 100 m/s. The whistle of the locomotive has a frequency of 400 Hz, and the speed of the sound is 1100 m/s. Find the frequency heard by the observer. (6)

5.2 Define resonance. (3)

Resonance is defined as the effect caused by a vibrating body setting another body vibrating, both having the same natural frequency.

5.3 A glass tube of 30 cm long contains water to a height of 20 cm. If a tuning fork of frequency 256 Hz is used to obtain the next position of resonance after the first when the water level is 25 cm below the open end, calculate the velocity of sound in the air. (5)

END OF EXAMINATION PAPER