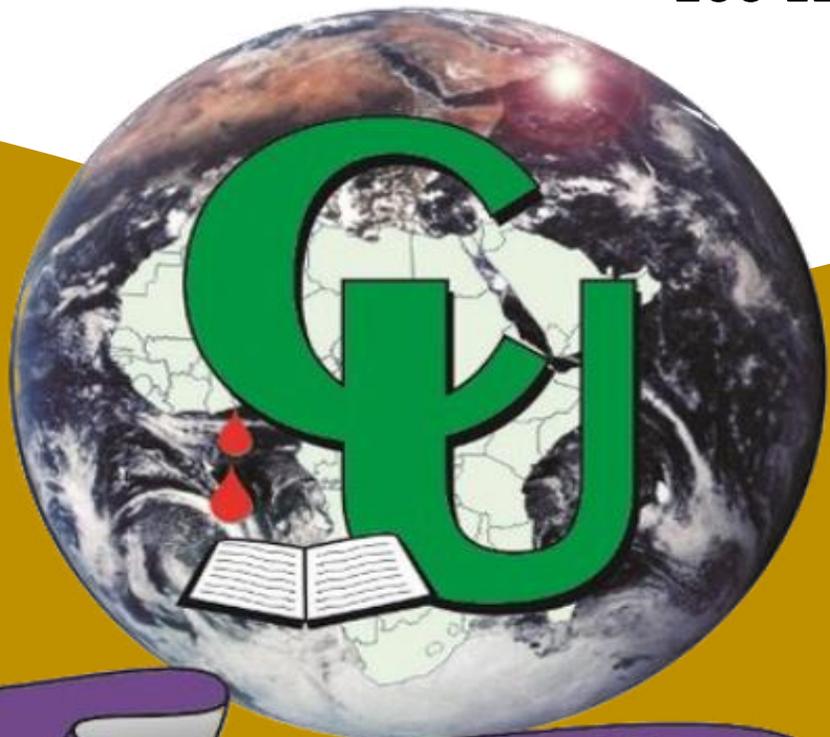


# COVENANT UNIVERSITY

ALPHA SEMESTER TUTORIAL KIT  
(VOL. 2)

PROGRAMME: PHYSICS  
100 LEVEL



*Raising A New Generation Of Leaders*

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## **LIST OF COURSES**

\*PHY111: Mechanics and Properties of Matter

PHY112: Heat, Sound and Optics

**\*Not included**



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CANAANLAND, KM 10, IDIROKO ROAD

P.M.B 1023, OTA OGUN STATE, NIGERIA

TITLE OF EXAMINATION: B. Sc DEGREE EXAMINATION

COLLEGE: SCIENCE AND TECHNOLOGY

SCHOOL: NATURAL AND APPLIED SCIENCES

DEPARTMENT: PHYSICS

SEMESTER: ALPHA

COURSE CODE: PHY 112

CREDIT UNIT(S): 2

COURSE TITLE: Heat, Sound and Optics

INSTRUCTIONS: Answer all the questions

TIME: 2 HOURS

1. A uniform of length  $l$ , mass  $m$  is fixed at both ends under tension  $T$ . Then it can vibrate with frequency  $f$  given by the expression?

(a)  $f = \frac{1}{2l} \sqrt{\frac{T}{m/l}}$

(b)  $f = \frac{1}{2} \sqrt{\frac{T}{ml}}$

(c)  $f = \frac{1}{2} \sqrt{\frac{T}{m/\mu}}$

(d)  $f = 2l \sqrt{\frac{T}{\mu}}$

2. With the increase in stretching force of a wire its frequency?

(a) Increases

- (b) Decreases  
(c) May increase or decrease  
(d) Remain the same
3. The fixed ends of a vibrating string are?  
(a) Overtones  
(b) Antinodes  
(c) Nodes  
(d) Neither nodes nor antinodes
4. How many nodes must be there between two antinodes?  
(a) 2  
(b) 1  
(c)  $2^2$   
(d) 3
5. In an open pipe, the fundamental note is produced with its length is equal to?  
(a)  $\frac{\lambda}{4}$   
(b)  $\frac{\lambda}{2}$   
(c)  $2\lambda$   
(d)  $\lambda$
6. A tuning fork of frequency 260 Hz is sounded with a fork of unknown frequency f Hz, 4 beats per second are heard. When a little wax is added to the prongs of the fork, the beats decrease in number. What is the frequency f?  
(a) 260 Hz  
(b) 264 Hz  
(c) 256 Hz  
(d) 258 Hz
7. What types of waves carry sound in air.....?  
(a) Transverse wave  
(b) Longitudinal wave  
(c) Electromagnetic wave  
(d) Transverse and longitudinal waves
8. When a source gives sound waves towards an observer at rest, the pitch of the note heard by the observer is higher due to the fact that  
(a) The wavelength of sound waves produced decreases

- (b) The velocity of sound waves decreases  
(c) The frequency of waves produced by source increases  
(d) The frequency of waves produced by source decreases
9. When a sounding body and listener approach each other the pitch appears to rise and when they move away from each other pitch appears to decrease. This is known as?  
(a) Doppler's effect  
(b) Newton's formula  
(c) Interference  
(d) Sabine's formula
10. The equation for a particular standing wave on a string is  $y = 0.15 \sin(80\pi t - 0.4\pi x)$  where  $y$  and  $x$  are in metres and  $t$  is in seconds. What is the speed of this wave?  
(a) 12 m/s  
(b)  $80\pi$  m/s  
(c) 200 m/s  
(d)  $0.4\pi$  m/s
11. The fundamental frequency of a closed pipe is 100 Hz. What is the length of the pipe?  
(Take speed of sound = 345 m/s)  
(a) 1.73 m  
(b) 3.45 m  
(c) 0.29 m  
(d) 0.86 m
12. The fundamental frequency of a wire 80 cm long is 200 Hz. If the tension is 36 N, the mass per unit length of the wire is about  
(a)  $3.5 \times 10^{-4} \text{ kg m}^{-1}$   
(b)  $2.8 \times 10^{-4} \text{ kg m}^{-1}$   
(c)  $1.4 \times 10^{-4} \text{ kg m}^{-1}$   
(d)  $0.8 \times 10^{-4} \text{ kg m}^{-1}$
13. The frequency of a soldier motorbike siren is 60 Hz. Calculate the apparent frequency received by a stationary observer, when the motorbike approaches him with a speed of  $50 \text{ ms}^{-1}$   
(a) 3000 Hz  
(b) 707.14 Hz

- (c) 521.05 Hz
- (d) 0.83 Hz
14. If the body's temperature is above 105 °F for a prolonged period, heat stroke can result. Express this temperature on the Celsius scales.
- (a) 41 °C  
(b) 131 °C  
(c) 73 °C  
(d) 52 °C
15. A spherical blackbody 5cm radius is maintained at temperature of 327 °C. What is the power radiated? ( $\sigma = 5.67 \times 10^{-8} \text{ Wm}^{-2}\text{K}^{-4}$ )
- (a)  $2.14 \times 10^{-5} \text{ W}$   
(b)  $7.34 \times 10^{-5} \text{ W}$   
(c)  $2.31 \times 10^2 \text{ W}$   
(d) 2308 W
16. What is the root-mean-square speed of an oxygen molecule at a temperature of 300 K? *Given that the molecular mass of oxygen is  $1.2 \times 10^{-3} \text{ kg}$  and molar constant is  $8.31 \text{ J/mol.K}$ .*
- (a) 7.20 m/s  
(b)  $2.50 \times 10^3 \text{ m/s}$   
(c)  $3.12 \times 10^3 \text{ m/s}$   
(d) 1.56 m/s
17. In a certain chemical process, a lab technician supplies 254 J of heat to a system. At the same time, 73 J of work are done on the system by its surroundings. What is the increase in the internal energy of the system?
- (a) 327 J  
(b) 181 J  
(c) 254 J  
(d) 203 J
18. A metal rod is 40.125 cm long at 20.0 °C and 40.148 cm long at 45.0 °C. Calculate the coefficient of linear expansion of the rod's material for this temperature range.
- (a)  $1.35 \times 10^{-5} \text{ K}^{-1}$   
(b)  $5.11 \times 10^{-5} \text{ K}^{-1}$

- (c)  $3.22 \times 10^{-5} \text{ K}^{-1}$
- (d)  $2.29 \times 10^{-5} \text{ K}^{-1}$

- 19 How much heat is required to raise the temperature of 0.250 kg of water from 20.0 °C to 30.0 °C. (Specific heat of water is 4200 J/kgK)
- (a) 10000 J
  - (b) 10500 J
  - (c) 120000 J
  - (d) 103500 J
- 20 The amount of heat required to raise the temperature of 1 g of water from 14.5 °C to 15.5 °C is called.....and its equivalent value in Joule is.....
- (a) Btu; 1055 J
  - (b) Reaumur; 800 J
  - (c) Calorie; 4.186 J
  - (d) Kelvin; 373 J
21. The glass windows of a room have a total area of 10 square metres and the glass is 4.1 mm thick. Calculate the rate at which heat escapes from the room by conduction when the inside surface of the windows are at 25 °C and the outside surface at 10 °C. K is 8.4 W/m.K.
- (a) 3.07 MW
  - (b) 30.73 MW
  - (c) 0.31 MW
  - (d) 3073 MW
22. *A system that both mass and energy can cross its boundary but the volume is fixed is called.....while the system that is mass and volume control is called.....*
- (a) Open; isolated
  - (b) Open; closed
  - (c) Closed; isolated
  - (d) Independent; closed
23. The density of helium at 0 °C and 76 cmHg is 0.18 kg/m<sup>3</sup>. Find the r.m.s velocity of helium molecules at 0 °C.
- (a) 12.67 m/s
  - (b) 1.26 m/s
  - (c) 2.28 m/s

- (d) 3.56 m/s
24. An ideal gas expands adiabatically to three times its original volume. In doing so, the gas does 720 J of work. Calculate how much heat flows from the gas and the change in internal energy of the gas
- (a) 370 J; 0 J  
(b) 0 J; 370 J  
(c) 0 J; 720 J  
(d) 720 J; 0 J
25. The unit of thermal conductivity is given by one of the following
- (a)  $\text{W/m}^2\text{K}$   
(b)  $\text{J/s.m.K}$   
(c)  $\text{W/mK}^4$   
(d)  $\text{J/mK}$
26. At what temperature is the numerical value on the Fahrenheit and Celsius scales the same?
- (a) 273.15 K  
(b) 373.15 K  
(c)  $0^0$   
(d)  $-40^0$
27. An observer on a beach watches the sunset due west. The water is very smooth with small ripples in some areas. The observer notices some pink and blue areas on the water. Explain why the water appears to have different colours.
- (a) The different colours is due to regular and diffuse reflection  
(b) Light from parts of the sky is partially reflected into the observer's eyes  
(c) The sky changes colours at the beginning of sunset  
(d) The smooth areas of water do not reflect light **specularly**.
28. A ray of light that has wavelength 589 nm travelling in air is incident o a piece of smooth crown glass at  $30^0$  to the normal. Find its angle of refraction,  $\theta_2$ .
- (a)  $15.0^0$   
(b)  $16.0^0$   
(c)  $17.7^0$   
(d)  $19.2^0$
29. One of the following is not true of Huygens's principle

- (a) The laws of reflection and refraction can be deduced by a geometric method
  - (b) A wave front is a surface passing through points of a wave that have different phase and amplitude
  - (c) All points on the wave are taken as point sources for the production of secondary spherical waves; wavelets.
  - (d) After time  $t$ , the new position of the wave front is the tangent to the wavelets.
30. The image of yourself in your mirror is
- (a) Upright, magnified, virtual, far behind the mirror as object in front
  - (b) Upright, real, diminished, far behind the mirror as object in front
  - (c) Upright, same size as object, virtual, far behind the mirror as object in front
  - (d) Inverted, same size as object, real, far behind the mirror as object in front
31. One of this best describes spherical aberration:
- (a) Rays forming a large angle with principal axis, converge to other points on the principal axis, producing a blurred image
  - (b) It is always present in spherical mirrors, the degree however differs
  - (c) Parabolic mirrors are used to minimize spherical aberration
  - (d) All of the above
32. Describe the image formed by a concave spherical mirror of focal length of 10.0 cm, when the object distance is 25.0 cm. The image is:
- (a) Real, inverted, diminished, in front of the mirror
  - (b) Virtual, erect, magnified, at the back of the mirror
  - (c) Real, erect, diminished, in front of the mirror
  - (d) Virtual, inverted, magnified, in front of the mirror
33. An orange on the centre of curvature of a concave mirror is:
- (a) Bigger, inverted, on C, in front of the mirror
  - (b) Same size as orange, inverted, on C, in front of the mirror
  - (c) Smaller, inverted, on C, in front of the mirror
  - (d) Bigger, inverted, on C, behind the mirror
34. A plastic sandwich bag filled with water can act as a crude converging lens in air. If the bag is filled with air and placed under water, its effective lens will be .....
- (a) Converging
  - (b) Diverging
  - (c) Both
  - (d) Not sufficient information

35. The near point of an eye is 50.0 cm. What focal length must a corrective lens have for the eye to see an object 25.0 cm away?
- (a) 30.0 cm
  - (b) 40.0 cm
  - (c) 50.0 cm
  - (d) 60.0 cm



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**COURSE TITLE: HEAT, SOUND AND OPTICS**

**MARKING GUIDE**

1. A
2. A
3. C
4. B
5. B
6. B
7. B
8. A
9. A
10. B
11. D
12. A
13. Bonus
14. A
15. B
16. B
17. B
18. D
19. B
20. C
21. C
22. A
23. D
24. C or 0 J; -720 J
25. B
26. D
27. A
28. Bonus
29. B
30. C

- 31. D
- 32. A
- 33. B
- 34. A
- 35. C