|  |  |  |
| --- | --- | --- |
| **Qn** | **Answer** | **Marks** |
| 1. (a) | |  |  | | --- | --- | | Transverse waves | Longitudinal waves | | * Propagate with vibrations perpendicular to the direction of travel * Can be polarized | * Propagate with vibrations parallel to the direction of travel * Cannot be polarised | | 1  1 |
| (b) | (i) The given equation is of the form: Y = a sin 2π  ∴  = 10 ⇒ T = **0.1 s** | 1  2 |
| (ii)  = 0.4 ⇒ λ = 2.5 m  V = fλ =  = 2.5 x 10 = **25 m s-1** | 1½  1½ |
| (c) | (i) This is the apparent change in the frequency of a wave motion when there is relative motion between the source and the observer. | 1 |
| (ii) Let us = velocity of the car = 90 km h-1 = 25 m s-1  V = velocity of sound  f = frequency of the siren  The apparent wavelength , λ′ =  Since the observer is stationary, the velocity remains unaffected  So apparent frequency, f′ =  =  =  = **1021 Hz** | 1  1  1 |
| (iii) Applications of Doppler effect:  Any one   * Speed detection, e.g. of vehicles * Determination of plasma temperature * In determining speed of a star or planet | 1 |
| (d) | ¼ λ  A  N  (i)  Air at end A vibrates with maximum amplitude  The amplitude of vibration decreases as the end N is approached.  Air at N is stationary.  A is the antinode while N is the node. | 1  ½  ½  ½  ½ |
| (ii) Wavelength of the fundamental mode, λo = 4*l* = 4 x 29 = 116 cm  If there were no end correction, the wavelength of the 3rd harmonic  λ1 = λo = x 116 = 38.7 cm  But the observed wavelength, λ =  = 39.5 cm  ⇒ The mode is the 3rd harmonic  Now 29 + c = λr  = x 39.5 = 29.63  ∴ c = **0.63 cm** | ½  1  ½  ½  ½  1 |
| ***Total = 20*** | | |
| 2. (a) | (i) ….the sum of the fluxes through the individual turns of a circuit (coil) | 1 |
| (ii) …the development of an emf in a coil due to fluctuation of current in a nearby coil. | 1 |
| (b) | B  E  I  R  Let R = total resistance of the circuit.  Φ = flux linkage at any instant  At any instant, the emf induced in the circuit is  E =  ∴ Current, I =  But the current, I = rate of flow of charge =  ∴  If the flux changes from, say Φ1 to Φ2, the total charge that circulates in the circuit is  ∴ Q =  Thus, the charge circulated is independent of the time taken. | 1  1  ½  ½  1 |
| (c) | (i) A heavy coil  - for a long period of oscillation so that all the charge flows through the coil  before it moves appreciably.  An insulating former  - to minimise damping of the oscillations of the coil.  No shunt  - so that all charge flows through the coil.  No shot-circuited turns  - so that all charge flows through each turn of the coil. | ½  ½  ½  ½  ½  ½  ½  ½ |
| (ii)  bG  C  K1  K2   * A capacitor of known capacitance, C, is charged to a known p.d, V, by closing switch K1. * K1 is opened and then K2 is closed while observing the pointer of the ballistic galvanometer and the throw, θ, is noted.   Now, the charge circulated through the galvanometer is Q = CV.   * By changing C or V, different values of charge, Q, are passed through the ballistic galvanometer, each time noting the corresponding throw, θ. * Then a graph of Q against θ is plotted.   Its gradient, s , is found. s =  = charge per deflection. | 1  ½  ½  ½  ½  ½  ½ |
| (d) | (i) The pointer remains at zero deflection since a steady current would not induce an emf | 1  1 |
| (ii) For the solenoid, n = 1000  ∴ Φ = BAN = μnIAN, where A = 12 x 10-4 m2 and N = 1000  Charge circulated in the coil is  Q =  = kθ ………………. (1)  Charge from the capacitor = CV = 100 x 10-6 x 12 = kθ′  where θ′ = 25 div.  ∴ 25k = 100 x 10-6 x 12  k =  = 4.8 x 10-5 C div-1  From (1) I =  =  = **12.7 A** | ½  ½  ½  ½  1  1 |
| ***Total = 20*** | | |