

Engineering physics (2022)

Q1. Choose the correct answer.

(i) The distance between Jamshedpur and Ranchi by road is 120.60 km. the number of significant digit in the measurement is

- (a) 3 (b) 4
(c) 5 (d) 2

Ans.(c)

(ii) A car is moving with a constant speed of 72km/hr. Total distance covered in 10 second will be

- (a) 720 m (b) 72 m
(c) 200 m (d) 20 m

Ans.(c)

(iii) The angular velocity of ... earth about its axis is

- (a) $\frac{2\pi}{86400}$ rad/s (b) $\frac{2\pi}{24}$ rad/s
(c) $\frac{2\pi}{365}$ rad/s (d) None of these

Ans.(a)

(iv) Which of the following is false?

- (a) $\gamma = \frac{9k\eta}{3k + \eta}$ (b) $\frac{1}{\gamma} = \frac{1}{3\eta} + \frac{1}{9k}$
(c) $\eta = \frac{3k\gamma}{9k - \gamma}$ (d) $k = \frac{\eta\gamma}{3\eta - 9\gamma}$

Ans.(d)

(v) The surface for pure water in a capillary tube experiment is

- (a) $\frac{2}{hrpg}$ (b) $\frac{2}{hrp}$
(c) $\frac{rpg}{2h}$ (d) $\frac{hrpg}{2}$

Ans.Out of Syllabus

(vi) Material medium is not necessary in

- (a) Conduction (b) Convection
(c) Radiation (d) None of these

Ans.(c)

(vii) In transverse wave, the direction of vibrations of particles of material medium and direction of propagation of wave are

- (a) perpendicular to each other
(b) opposite to each other
(c) Parallel to each other

(d) at an angle of 30° with each other

Ans.(a)

(viii) The distance between two successive modes is

- (a) $\frac{\lambda}{4}$ (b) $\frac{\lambda}{2}$
(c) λ (d) 2λ

Ans.(b)

Q2. (a) State the three Newtons laws of motion.

Ans.Refers to Chapter 2

Q2.(b) A stone is thrown vertically upwards with an initial velocity of 29.4 m/s. Find the time taken by the stone to reach the same point. $g = 9.8\text{m/s}^2$

Ans. Given,

Initial velocity,

$u = -29.4\text{ m/s}$ (Minus sign due to upward motion)

Let t = Time taken by the stone to reach the foot of the tower

We know that, height of the tower (h),

$$34.3 = ut + \frac{1}{2}gt^2 = (-29.4 \times t) + \frac{1}{2} \times 9.8t^2$$

$$\text{or } 4.9t^2 - 29.4t - 34.3 = 0$$

$$t^2 - 6t - 7 = 0$$

This is a quadratic equation in t .

$$\text{Hence, } t = \frac{+6 + \sqrt{(6)^2 + (4 \times 7)}}{2} = \frac{6 \pm 8}{2} = 7\text{s}$$

Q2.(c) Define measurement and unit. What are the requirements of a good standard unit?

Ans.Measurement: Measurement is a technique in which the properties of an object are determined by comparing them to a standard quantity. Also, measurement is the essential metric to express any quantity of objects, things and events.

Unit and requirements of a good standard unit: Refers to Chapter 1

Q3.(a) What is Simple Harmonic Motion? Find an expression for a displacement of a body executing SHM.

Ans.Out of Syllabus

Q3.(b) Define work, power and energy with their S.I. units. Explain work energy principle.

Ans.Out of Syllabus

Q3.(c) What are the factors that affect acceleration due

to gravity (g)? Calculate the gravitational force of attraction between earth and sun. Mass of earth is 6×10^{24} kg and mass of sun is 2×10^{30} kg. Average distance between earth and sun is 1.5×10^{11} m.

Ans. Factors that affect acceleration due to gravity (g): Refers to Chapter 2

Given: Mass of earth (m) = 6×10^{24} kg.

Mass of sun (M) = 2×10^{30} kg

Distance between sun and earth

$$(r) = 1.5 \times 10^{11} \text{ m}$$

Force of gravitation between them

$$F = \frac{GMM}{r^2}$$

$$F = \frac{6.67 \times 10^{-11} \times (6 \times 10^{24}) \times (2 \times 10^{30})}{(1.5 \times 10^{11})^2}$$

$$= 3.557 \times 10^{22} \text{ N}$$

Q4.(a) Define co-efficient of viscosity and write its dimension.

Ans. Out of Syllabus

Q4.(b) Define Surface tension. Explain the phenomenon with the help of a Laplace molecular theory with a neat diagram.

Ans. Out of Syllabus

Q4.(c) Out of steel and rubber, which is more elastic and why? A wire of length 3m extends by 3 mm when a deforming force is applied to it. Calculate stress produced in it if $Y = 2 \times 10^{11} \text{ N/m}^2$.

Ans. Steel and rubber, which is more elastic: Refers to Chapter 2.

The strain produced in the wire can be calculated using the formula:

$$\text{Strain} = \frac{\text{extension}}{\text{original length}}$$

Here, the extension in the wire is 3 mm = 0.003 m, and the original length is 3 m. Therefore,

$$\text{Strain} = \frac{0.003}{3} = 0.001$$

The stress produced in the wire can be calculated using the formula:

$$\text{stress} = (\text{Young's modulus}) \times (\text{strain})$$

Here, the Young's modulus (Y) is given as $2 \times 10^{11} \text{ N/m}^2$, and the strain is 0.001. Therefore,

$$\text{stress} = (2 \times 10^{11} \text{ N/m}^2) \times (0.001) = 2 \times 10^8 \text{ N/m}^2$$

Therefore, the stress produced in the wire is $2 \times 10^8 \text{ N/m}^2$.

Q5.(a) State the law of thermal conductivity of Heat and define co-efficient of thermal conductivity. Write its S.I. unit.

Ans. Refers to Chapter 3

Q5.(b) Define amplitude, time period, frequency and wavelength of a sound wave.

Ans. Refers to Chapter 3

Q5.(c) A spherical ball of radius 2 mm and density $8 \times 10^3 \text{ kg/m}^3$ falls through a liquid of density $1.3 \times 10^3 \text{ kg/m}^3$. Find the terminal velocity. Given η for liquid = 0.83 Ns/m^2 .

Ans. Out of Syllabus

Q6. Define echo and reverberation time. How is reverberation reduced in a good auditorium?

Ans. Out of Syllabus