



PHYSICS

BOOKS - NAVBODH PHYSICS (HINGLISH)

SOLVED PROBLEMS - I

Circular Motion

1. What is the angular displacement in radian of the second hand of a clock in 10 seconds ?



[Watch Video Solution](#)

2. What is the tangential acceleration of a flywheel of diameter 60 cm when it slows down uniformly at the rate of 0.25 rad/s^2 ?



[Watch Video Solution](#)

3. A body is tied to one end of a string and revolved in a horizontal circle of radius 50 cm at a constant angular speed of 20 rad/s . Find

the (i) linear speed (ii) Centripetal acceleration of the body .



[Watch Video Solution](#)

4. To simulate the acceleration of large rockets, the astronauts are spun at the end of long rotating beam of radius 9.8 m . What will be angular velocity required for generating centripetal acceleration 8 times the acceleration due to gravity?



[Watch Video Solution](#)

5. If a body of mass 1000 gm is tied to free end of string of length 100 cm and whirled in a horizontal circle in a second, then the tension in the string will be



[Watch Video Solution](#)

6. A car of mass kg rounds a curve of radius 250 m at 90 km/h. Find the centripetal force acting on it .



[Watch Video Solution](#)

7. Find the maximum speed with which a car be safely driven along a curve of radius 100 , . If the coefficient of friction between its tyres and the road is 0.2.



[Watch Video Solution](#)

8. A circular race track of radius 400 m is banked at an angle of 10° . If the coefficient of friction between the wheels of a race car and

the road is 0.2 , what is the (i) optimum speed of the race car to avoid wear and tear on its tyres .

maximum permissible speed to avoid slipping ?



[Watch Video Solution](#)

9. The two rails of a railway track are 1.7 m apart. At a circular curve of radius 1.5 km, a train should have an optimum speed of 108 kmph so that there is no side thrust on the

outer rail. Find the angle of banking of the track and the elevation of the outer rail above the inner rail .



[Watch Video Solution](#)

10. The radius of curvature of a road is 60 m. if the angle of banking is 27° find the maximum speed with which a vehicle can turn safely along this curve.



[Watch Video Solution](#)

11. A string of length 0.5 m carries a bob of mass 0.1 kg at its end. If this is to be used as a conical pendulum of period 0.4π s, calculate the angle of inclination of the string with the vertical and the tension in the string .



Watch Video Solution

12. A motorcyclist is describing a circle of radius 25 m at a speed of 5 m/s . Find the inclination with the vertical and the coefficient of friction between the tyres and ground.



[Watch Video Solution](#)

13. A motor cycle rides in a hollow sphere in a vertical circle of radius 30 m .What will be the minimum speed required so that he does not lose contact with the surface of sphere at the highest point?



[Watch Video Solution](#)

14. A stone of mass 100 g attached to a string of length 50 cm is whirled in a vertical circle by giving it a velocity of 7 m/s at the lowest point. Find the velocity at the highest point .



Watch Video Solution

15. A conical pendulum has length of 1.1 m and the angle subtended by the string with the vertical is $25^\circ 31'$. Find (i) the angular speed (ii) the frequency of circular motion of the bob.





[Watch Video Solution](#)

16. An aeroplane flying in the sky dives with a speed of $360\text{km}/\text{h}$ in a vertical circle of radius 200 m . The weight of pilot sitting in it is 75 kg . Calculate the force with which the pilot presses his seat when the aeroplane is (i) at the lowest position and (ii) at the highest position. Take $g = 10\text{m}/\text{s}^{-2}$.



[Watch Video Solution](#)

17. A wheel, starting from rest, turns, through 360 rad with a constant angular acceleration of 5 rad/s^2 . (i) what is its final angular velocity? (ii) How much time elapses while it turns through the 360 radians?



View Text Solution

18. The spin dryer of washing machine rotating at 15 rps slows down to 5 rps after making 50 rotations. Find the its angular acceleration.





[Watch Video Solution](#)

Gravitation

1. If the Earth were a homogenous sphere of wood of density 800 kg/m^3 . What would be (i) the acceleration due to gravity on the Earth's surface ? (ii) the critical velocity of a satellite orbiting close to its surface ?



[View Text Solution](#)

2. A satellite revolves around the earth in an elliptical orbit. Its speed is



Watch Video Solution

3. The acceleration due to gravity on the surface of earth varies



Watch Video Solution

4. A satellite is taken to a height equal to the radius of the Earth and then projected horizontally with a speed of 7 km/s . State the nature of its orbit.



[Watch Video Solution](#)

5. Calculate the period of revolution of a satellite orbiting above the surface of the Earth at a distance equal to 9 times the radius of the Earth.





[Watch Video Solution](#)

6. What would be the duration of the year if the distance between the sun and the Earth were to become half the present distance ?



[Watch Video Solution](#)

7. Find the total energy and binding energy of a satellite of mass 1000 kg orbiting the Earth at a height of 1600 km above the Earth's surface.



[Watch Video Solution](#)

8. How much above the surface of the earth does the acceleration due to gravity reduce by 36 % of its value on the surface of the earth.



[Watch Video Solution](#)

9. Calculate the percentage decrease in the weight of a body when it is taken 32 km below the surface of the Earth .



[Watch Video Solution](#)

Rotational Motion

1. A wheel is rotating at 60 rotations per minute. If 480 J of energy is required to double its rotational speed, calculate the moment of inertia of the wheel.



[View Text Solution](#)

2. A torque of magnitude 400 N.m, acting on a body of mass 40 kg, Produces an angular acceleration of 20 rad/s^2 . Calculate the moment of inertia and radius of gyration of the body.



[Watch Video Solution](#)

3. A body starts rotating from rest. Due to a torque of 10 N.m, it completes 300 rotations in

one minute. Find the moment of inertia of the body.



[Watch Video Solution](#)

4. A torque of 160 N.m is applied to a body capable of rotating about a given axis. If the body starts from rest and acquires kinetic energy of 8000 J in 5 seconds, find (i) its moment of inertia about the given axis(ii) its angular momentum at the end of 5 seconds.



[Watch Video Solution](#)

5. A thin uniform rod 1 m long has mass 1 kg. Find its moment of inertia and radius of gyration for rotation about a transverse axis through a point midway between its centre and one end.



[Watch Video Solution](#)

6. A solid sphere rolls up a plane inclined at 45° to the horizontal. If the speed of its centre of mass at the bottom of the plane is 5

m/s , find how far the sphere travels up the plane.



Watch Video Solution

7. A solid cylinder, of mass 2 kg and radius 0.1 m, rolls down an inclined plane of height 3m. Calculate its rotational energy when it reaches the foot of the plane.



Watch Video Solution

8. A solid sphere of radius 25 cm and mass 25 kg rotates about an axis through its centre. Calculate its moment of inertia if its angular velocity changes from 2 rad/s to 22 rad/s in 5 seconds.

Also calculate the torque applied.



Watch Video Solution

9. Two wheels, each of moment of inertia $4 \text{ kg} \cdot \text{m}^2$, rotate side by side at the rate of 120 rpm

and 240 rpm in opposite directions. If both the wheels are coupled by a light shaft so that they now rotate with a common angular speed, find this new rate of rotation.



[Watch Video Solution](#)

10. A uniform horizontal disc is freely rotating about a vertical axis through its centre at the rate of 240 rpm. A blob of wax of mass 2 g falls on it and sticks to it at 25 cm from the axis. If the frequency of rotation of the disc is

reduced by 60 rpm. calculate the moment of inertia of the disc. It



[Watch Video Solution](#)

11. A ballet dancer spins about a vertical axis at 100 rpm which arms outstretched. With the arms folded, the moment of inertia about the same axis of rotation changes to 80% of its initial value.

Calculate the new frequency of rotation.



[Watch Video Solution](#)

12. The equation of linear SHM is $x = 10 \sin\left(4\pi t + \frac{\pi}{6}\right)$ cm. Find the period and maximum speed of the motion.



[Watch Video Solution](#)

13. Find the maximum velocity and maximum acceleration of a particle performing SHM whose displacement is given by $x = 2 \cos(50t)$ cm.



[Watch Video Solution](#)

14. A particle performs SHM of amplitude 10 cm. Its maximum velocity during oscillations is 100 cm/s. What is its displacement, when the velocity is 60 cm/s ?



Watch Video Solution

15. The diameter of the reference circle for a particle performing linear SHM is 10 cm. If the reference particle performs UCM with period

2π seconds, what is the maximum acceleration of the particle in linear SHM ?



[Watch Video Solution](#)

16. A load of mass 100 gm increases the length of wire by 10 cm. If the system is kept in oscillation, its time period is ($g = 10m / s^2$)



[Watch Video Solution](#)

17. A particle performs a linear S.H.M. of period 3 second. The time taken by the particle to cover a distance equal to half the amplitude, from the mean position is



Watch Video Solution

18. A particle performs linear SHM of period 12 seconds and amplitude 8 cm. How long will the particle take to travel 6 cm from the positive extremity ?





[Watch Video Solution](#)

19. A particle in linear SHM has speeds 4 cm/s and 3 cm/s when its displacements from the mean position are 3 cm and 4 cm , respectively. Find its period of oscillation.



[Watch Video Solution](#)

20. The potential energy of a particle in SHM is 2×10^{-4} J at the extreme positions. What will be its potential energy when the particle is

midway between the mean and extreme position ?



[Watch Video Solution](#)

21. The total energy of a particle of mass 0.1 kg performing SHM is 0.2 J . Find its maximum speed and period if the amplitude is 2 cm .



[View Text Solution](#)

22. A particle of mass 10 g is performing SHM. Its kinetic energies are 4.7 J and 4.6 J when the displacements are 4 cm and 6 cm , respectively. Compute the period of oscillation.



Watch Video Solution

23. A particle is performing SHM with amplitude 2 cm. At what distance from the equilibrium position is its energy half potential ? What is the maximum velocity of

the particle if the frequency of its oscillation is 50 Hz.



[Watch Video Solution](#)

24. A body of mass 0.1 kg performing linear SHM experiences a restoring force of 1 N when its displacement from the mean position is 5 cm. Find (i) the force constant (ii) the period of SHM (iii) the acceleration of the body, when its displacement from the mean position is 1 cm./



[View Text Solution](#)

25. An SHM is given by the equation $x = 8 \sin(4\pi t) + 6 \cos(4\pi t)$ cm find its amplitude and period



Watch Video Solution

26. Define linear simple harmonic motion. Assuming the expression for displacement of a particle starting from extreme position, explain graphically the variation of velocity and acceleration w.r.t. time.

A clock regulated by seconds pendulum, keeps correct time. During summer, length of pendulum increases to 1.005 m. How much will the clock gain or lose in one day ($g = 9.8 \text{ m/s}^2$ and $\pi = 3.142$).



[Watch Video Solution](#)

Elasticity

1. A brass wire of radius 0.25 mm and length 2 m is stretched by applying a force of 2 kg wt.

Calculate (i) the increase in length of the wire

(ii) the strain. [$Y = 9 \times 10^{10} \text{ N/m}^2$]



Watch Video Solution

2. There are two wires of same material. Their radii and lengths are both in the ratio 1:2 If the extensions produced are equal, the ratio of the loads is



Watch Video Solution

3. Find the increase in pressure required to decrease the volume of given mercury by 0.001 %

[Bulk modulus of mercury = $2.8 \times 10^{10} \text{ N/m}^2$]



[Watch Video Solution](#)

4. Tangential forces of magnitude $4 \times 10^8 \text{ N}$ are applied to the opposite faces of a metal cube of side 0.5 m. What is the shear stress on the cube ?





[Watch Video Solution](#)

5. A metal plate has the dimensions $10\text{cm} \times 10\text{cm} \times 1\text{mm}$. One of its faces having larger area is fixed and a tangential force is applied to the opposite larger face. If the lateral displacement between the two surfaces is $1.2 \times 10^{-3}\text{mm}$, and the modulus of rigidity of the metal is $5 \times 10^{10}\text{N/m}^2$, then the tangential force is



[Watch Video Solution](#)

6. The maximum load that may be applied to a mild steel wire is 7 kg wt. If the radius of the wire is 0.2 mm, find the maximum elastic strain permitted. $[Y = 2 \times 10^{11} N/m^2]$



[Watch Video Solution](#)

7. A steel wire of length 7 m and cross section $1mm^2$ is suspended from a rigid support, with a steel weight of volume $10^3 cm^3$ hanging from its other end. Find the decrease in the length of the wire when the steel weight is

completely immersed in water.

$$Y_{\text{steel}} = 2 \times 10^{11} \text{ N/m}^2 \quad \text{density of water} \\ = 10^3 \text{ kg/m}^3]$$



[Watch Video Solution](#)

8. A uniform steel wire of length 6 m and area of cross section 2mm^2 is elastically stretched through 3 mm. Calculate the energy stored in the wire. $[Y_{\text{steel}} = 2 \times 10^{11} \text{ N/m}^2]$



[Watch Video Solution](#)

9. A steel wire having cross-sectional area 2 mm^2 is stretched by 20 N. Find the lateral strain produced in the wire $Y_{\text{steel}} = 2 \times 10^{11} \text{ Nm}^{-2}$, $\sigma = 0.391$



[Watch Video Solution](#)

10. When a metal rod is heated through 30°C the thermal strain in the rod is 3.6×10^{-4} . What is the coefficient of linear expansion of the metal?



[Watch Video Solution](#)

11. A uniform steel rod of cross section 5mm^2 is heated from 0°C to 25°C . Find the force which must be exerted to prevent it from expanding. Also, find the energy stored per unit volume of the rod.



Watch Video Solution

12. A bar of length 1 m is supported at its two ends. The breadth and depth of the bar are 5

cm and 0.5 cm., respectively , A body of mass 0.1 is suspended at the centre of the bar. Calculate the depression produced in the bar.



[View Text Solution](#)

13. A horizontal circular loop of wire has radius 0.04 m. It is lowered into a liquid and a film is formed . The force due to the surface tension of the liquid is 0.033 N. Calculate the surface tension of the liquid.



[Watch Video Solution](#)

14. The potential energy of the free surface of a liquid drop is $2\pi \times 10^{-5}$ times the surface tension of the liquid. What is the radius of the drop ? (Assume all quantities are in SI units)



Watch Video Solution

15. Two soap bubbles of the same soap solution have diameters in the ratio 1 :2. What is the ratio of work done to blow these bubbles ?



[Watch Video Solution](#)

16. IF the surface tension of liquid is 70 dyn/cm, what is the total energy of the free surface of the liquid drop of radius 0.1 cm ?



[Watch Video Solution](#)

17. Calculate the work done when a spherical drop of mercury of radius 1 mm falls from some height and breaks into 27 droplets. each

of the the same size. The surface tension of mermcury is $T = 0.47 \text{ N/m}$.



[Watch Video Solution](#)

18. Calculate the work done in increasing the radius of a soap bubble in air from 2 cm to 3 cm. The surface tension of the soap solution is 27 dyn/cm.



[Watch Video Solution](#)

19. What is the excess of pressure inside a soap bubble of radius 3cm if the surface tension of the soap solution is 30 dyn/cm ?



[Watch Video Solution](#)

20. Two soap bubbles of the same soap solution have radii 3 cm and 1.5 cm. If the excess pressure inside the bigger bubble is 40dyn/cm^2 what is the excess pressure inside the smaller bubble ?





[Watch Video Solution](#)

21. Calculate the pressure inside a raindrop of diameter 2 mm [surface tension of water = 0.072 N/m]



[Watch Video Solution](#)

22. In a liquid there is air bubble of radius 1 mm at a depth 10 cm below the free space. The surface tension of liquid 0.075 N/m and density is 1000 kg/m^2 . By what amount is the

pressure inside the bubble greater than the atmospheric pressure ?



[Watch Video Solution](#)

23. Two soap bubbles A and B are kept in a closed chamber where the air is maintained at pressure $8N/m^2$. The radii of bubbles A and B are $2cm$ and $4cm$, respectively. Surface tension of the soap. Water used to make bubbles is $0.04N/m$. Find the ratio n_B/n_A , where n_A and n_B are the number of moles of

air in bubbles A and B respectively. [Neglect the effect of gravity.]



[Watch Video Solution](#)

24. Calculate the density of paraffin oil. If within a glass capillary tube of radius 0.25 mm dipped in paraffin oil of surface tension 0.0245 N/m, to a height of 2cm. [Angle of contact of paraffin oil with glass = 28°]



[Watch Video Solution](#)

25. The tube of a mercury barometer is 1 cm in diameter. What correction due to capillarity is to be applied to the barometric reading if the surface tension of mercury is 435.5 dyn/cm and the angle of contact of mercury with glass is 140° ?



Watch Video Solution

26. The surface tension of water at $0^\circ C$ is 75.5 dyn/cm. Calculate the surface tension of water at $25^\circ C$.



[Watch Video Solution](#)

Wave Motion

1. Write the equation of a simple harmonic progressive wave of amplitude 0.01 m and frequency 100 Hz travelling along the positive x-axis with a speed of 50 m/s.



[Watch Video Solution](#)

2. A simple harmonic progressive wave is given by the equation, $y = 0.1 \sin 4\pi(50t - 0.2x)$ in SI units. Find the period, wavelength and speed of the wave.



[Watch Video Solution](#)

3. The equation of a simple harmonic progressive wave is

$$y = A \sin 100\pi \left(t - \frac{x}{100} \right)$$

with all quantities

in SI units. What is the speed of the wave ?





[Watch Video Solution](#)

4. A simple harmonic progressive wave has frequency 25 Hz and wavelength 4m. If the phase difference between motions of two particles is $\left(\frac{\pi}{10}\right)$ rad. What is the corresponding path difference ?



[Watch Video Solution](#)

5. A simple harmonic wave of amplitude 0.2 cm, frequency 1000 Hz and wavelength 0.31 m

is travelling along the positive x-axis .

Calculate the displacement of the particle at 3.1 m from the origin after 1.004 s. What would be the phase difference for two positions of the vibrating particle after an interval of 0.001 s ?



[View Text Solution](#)

6. A tuning fork has frequency 512 Hz. What can you say about its frequency when (i) its

prongs are filed (ii) some wax is applied to its prongs ?



[View Text Solution](#)

7. Two tuning forks C and D give four beats per second, the frequency of C being 480 Hz. When fork D is filed a little, again four beats per second are produced . Calculate the frequency of fork D before and after filing.



[View Text Solution](#)

8. If beat frequency is 10 Hz, find the time interval between (i) successive waxings.



[Watch Video Solution](#)

9. A set of 12 tuning forks is arranged in order of increasing frequencies. Each fork produces Y beats per second with the previous one. The last is an octave of the first. The fifth fork has frequency of 90 Hz. Find Y and the frequency of the first and the last tuning forks.



[View Text Solution](#)

10. Prove the law of conservation of energy for a particle performing simple harmonic motion. Hence graphically show the variation of kinetic energy and potential energy w.r.t. instantaneous displacement.

Two sound notes have wavelengths $\frac{83}{170}m$ and $\frac{83}{172}m$ in the air. These notes when sounded together produce 8 beats per second. Calculate the velocity of sound in the air and frequencies of the two notes.



 [Watch Video Solution](#)

11. A stationary source produces a note of frequency 1000Hz . An observer in a car moving towards the source measures the frequency of sound as 1057 Hz . Find the speed of the car. What will be the frequency of sound as measured by the observer in the car if the car moves away from the source at the same speed ?



[View Text Solution](#)

Stationary Waves

1. The equation of a stationary wave is

$$y = 0.04 \sin 200\pi t \frac{\cos(\pi x)}{0.3}$$
 with all quantities

in SI units. What is the speed of the waves superposed ?



[Watch Video Solution](#)

2. The equation of a stationary wave is $y = 0.05 \sin 200\pi t \cos \pi x$ with all quantities in SI units.

What is the maximum speed of a particle at an antinode ?



[Watch Video Solution](#)

3. A sonometer wire is resonating with a tuning fork of frequency N . If its length is increased by 10% , by keeping the tension constant , 6 beats are heard per second, then



[Watch Video Solution](#)

4. Two strings have lengths in the ratio $2:3$, radii in the ratio $3:4$. They are tensioned in the ratio $16:25$. If they are made of the same material, the ratio of the frequencies emitted by them in the fundamental mode is



[Watch Video Solution](#)

5. A stretched wire under a tension of 4 kg wt is in unison with a tuning fork of frequency 512 Hz . How should the tension be altered to make

the wire vibrate in unison with a tuning fork of frequency 256 Hz ?



[Watch Video Solution](#)

6. Two tuning forks when sounded together produce 5 beats per second. A sonometer wire of length 0.24 m is in unison with one of the forks. When the length of the wire is increased by 1 cm, it is unison with the other fork. Find the frequencies of the tuning forks.



[Watch Video Solution](#)

7. The fundamental frequency of air column in a pipe open at both ends is 200 Hz. What is the frequency of the (i) second harmonic (ii) third overtone ?



[Watch Video Solution](#)

8. The fundamental frequency of air column in a pipe open at both ends is 200 Hz. What is the frequency of the (i) second harmonic (ii) third overtone ?



[Watch Video Solution](#)

9. Stationary waves in the air column inside a pipe of length 50 cm and closed at one end have three nodes and three antinodes. What is the wavelegth ?



[Watch Video Solution](#)

10. Find the frequency of the third overtone of an air column vibrating in a pipe closed at one

end. The length of the pipe is 30cm and the inner diameter of the pipe is 2 cm the speed of sound in air at room temperature is 350 m/s .



[View Text Solution](#)

11. Two pipes closed at one end, 51 cm and 52 cm long, produce 3 beats per second when they are sounded together in their fundamental modes. Ignoring the end correction, calculate the speed of sound in air.



[View Text Solution](#)

12. A pipe which is open at both ends is 47 cm long and has an inner diameter 5 cm. If the speed of sound in air is 348 m/s, calculate the fundamental frequency of air column in that pipe.



[Watch Video Solution](#)

13. The Fundamental frequency of a pipe closed at one end is in unison with the second

overtone of an open pipe. Calculate the ratio of the length of their air columns. Ignore the end correction.



[View Text Solution](#)

14. A stretched wire emits a fundamental note of frequency 256Hz. Keeping the stretching force constant and reducing the length of the wire by 10cm, frequency becomes 320Hz. Calculate original length of the wire.



[Watch Video Solution](#)

15. A sonometer wire is in unison with a tuning fork of frequency 107 Hz when it is stretched by a certain weight. When the weight is completely immersed in water, 7 beats are heard per second. Find the specific gravity of the material of the weight.



View Text Solution

16. A somometer wire produces 2 beats per second with a tuning fork, when the length of

the wire is either 102cm or 104 cm . The frequency of the tuning fork is



[Watch Video Solution](#)

17. the angular velocity ω of a particle varies with time t as $\omega = 5t^2 + 25ra \frac{d}{s}$. the angular acceleration of the particle at $t = 1s$ is

A. $10ra \frac{d}{s^2}$

B. $5ra \frac{d}{s^2}$

C. Zero

$$D. 3ra \frac{d}{s^2}$$

Answer:



Watch Video Solution

Kinetic Theory Of Gases And Radiation

1. The peressure exerected by a certain mass of enclosed gas at 300 K is $5 \times 10^4 N/m^2$.what will be the pressure exerted by the has ay 600 K if the volume of the gas is kept constant ?



[Watch Video Solution](#)

2. 16 g of oxygen occupy 0.02m^3 at 27°C . Find the pressure exerted by it. [Molar mass of oxygen = 32 g/mo. , universal gas constant $R = 8.314 \text{ /mol.K}$]



[Watch Video Solution](#)

3. Two tanks of equal volume contain equal masses of oxygen and nitrogen at 410 K. find the ratio of (i) the number of molecules of the

gases (ii) the pressure exerted by the gases in the two tanks .



[Watch Video Solution](#)

4. What is the kinetic energy per unit volume of a gas if the gas pressure is 10^5 N/m^2 ?



[Watch Video Solution](#)

5. The rms speed of oxygen molecules at a certain temperature is 400 m/s . What is the

rms speed of nitrogen molecules at the same temperature ?



[Watch Video Solution](#)

6. The kinetic energy per unit mass of a certain gas at 300 K is 1.3×10^5 J/Kg . What will be the kinetic energy per unit mass of the gas at 600 K ?



[Watch Video Solution](#)

7. Calculate the total kinetic energy of one kilo mole of Oxygen gas at $27^{\circ}C$



[Watch Video Solution](#)

8. The kinetic energy of 1 kg of oxygen at 300 K is 1.169×10^5 J . Find the kinetic energy of 2 kg of oxygen at 500 K.



[Watch Video Solution](#)

9. Calculate the rms speed of helium atoms at $127^{\circ}C$.



[Watch Video Solution](#)

10. Find the number of molecules per unit volume of oxygen at NTP. [Mass of an oxygen molecule = 5.313×10^{-26} kg, rms speed of oxygen molecules at NTP = 461.2 m/s]



[View Text Solution](#)

11. What is the thermal efficiency of a heat engine if in one cycle the work output is 3000 J and the heat input is 10000 J ?



Watch Video Solution

12. In one cycle, a heat engine rejects 80% of the energy absorbed from the hot reservoir to the cold reservoir . Calculate the efficiency of the engine.



Watch Video Solution

13. In a refrigerator, the external work done on the working substance in one cycle is 20% of the energy extracted from the cold reservoir. The coefficient of performance of the refrigerator is



Watch Video Solution

14. Radiant energy is incident on a body at the rate of 1000 joules per minute. If the reflection coefficient of the body is 0.2 and its

transmission coefficient is 0.3, find the radiant energy (i) absorbed (ii) reflected (iii) transmitted by the body in 3 minutes.



[View Text Solution](#)

15. A black body A at a temperature of $527^{\circ}C$, emits radiant energy at the rate of 16 watt. Another black body B at temperature $127^{\circ}C$, emits radiant energy at the rate 8 watt in the same surrounding. Compare the surface areas of A and B.



[Watch Video Solution](#)

16. The maximum radiant power of a certain star is at wavelength 600 nm. The wien displacement law constant is 2.898×10^{-3} m.K. Estimate the temperature of the surface of the star. Assume the star to be a blackbody radiator.



[Watch Video Solution](#)

17. A hot water radiator at 310 K temperature radiates thermal radiation like a black body. Its total surface area is $1.6m^2$. Find the thermal power radiated by it.



Watch Video Solution

18. If the emissive power of a certain body at a certain temperature is $2000 W / m^2$ and the emissive power of a perfect blackbody at the

same temperature is $10000 \text{ W} / \text{m}^2$, what is the coefficient of emission of the body ?



[Watch Video Solution](#)

19. What is the emissive power of a perfect blackbody at 1000 K ?



[Watch Video Solution](#)

20. A Fey 's blackbody is at 727°C . What is the power radiated per unit area through its hole

?



[Watch Video Solution](#)

21. Compare the rates of radiation of a metal sphere at 600 K and 300 K



[Watch Video Solution](#)

22. Assume that a 100W electric bulb loses its energy entirely by radiation from the surface of its filament . If the surface area of the

filament is 2cm^2 and its coefficient of emission is 0.4 , calculate the temperature of the filament.



[Watch Video Solution](#)

23. A body of surface area 10cm^2 and temperature 727°C emits 600 J of energy per minute. Find its emissivity.



[Watch Video Solution](#)

24. Calculate the energy radiated in one minute by a blackbody of surface area 100cm^2 when it is maintained at 127°C .



Watch Video Solution

25. A hot metal sphere cools from 60°C to 52°C in 5 minutes and from 52°C to 44°C in the next 7.5 minutes. Determine its temperature after the next 10 minutes.





[Watch Video Solution](#)

26. A hot body is kept in cooler surroundings. Its rate of cooling is $3^{\circ}C/\text{min}$ when its temperature is $60^{\circ}C$ and $1.5^{\circ}C/\text{min}$ when its temperature is $45^{\circ}C$. Determine the temperature of the surroundings and the rate of cooling when the temperature of the body is $40^{\circ}C$



[Watch Video Solution](#)

Assignments

1. Propeller blades, 2 m long , are rotating at 1800 rpm. What is the linear speed of the tip of the blades ?



[Watch Video Solution](#)

2. Determine the speed of the tip of a minute hand of length 10 cm of a wall clock.



[Watch Video Solution](#)

3. The speed a motorcycle moving along a circular road of radius 300 m, is increasing at the rate of 4 m/s^2 . Calculating the acceleration of the motorcycle when its speed is 30 m/s



[Watch Video Solution](#)

4. The angular speed of rotation of the earth is



[Watch Video Solution](#)

5. A coin placed on a horizontal rotating disc, with its centre at 10 cm from the centre of the disc, is about to slip off when the disc performs 60 rpm. Find the coefficient of friction between the coin and the disc.



[Watch Video Solution](#)

6. A particle moves along a circular path a radius 15 cm with a constant angular acceleration of 4 rad/s^2 . If the initial

angular speed of the particle was 5 rad/s . Find its angular displacement in 5 seconds.



Watch Video Solution

7. As astronaut in a spaceship orbiting around the Earth has a centripetal acceleration of 6.67 m/s^2 . Find the height of the spaceship above the surface of the Earth.



Watch Video Solution

8. The maximum range of projectile is $2/\sqrt{3}$ times actual range. What is the angle of projection for the actual range ?



[Watch Video Solution](#)

9. Calculate the escape speed of a body from the surface of a planet of mass 6.4×10^{23} kg and radius 3400 km.



[Watch Video Solution](#)

10. Three particles of masses 1.0 kg , 2.0 kg and 3.0 kg are placed at the corners A, B and C respectively of an equilateral triangle ABC of edge 1 m . Locate the centre of mass of the system.



Watch Video Solution

11. Calculate the moment of inertia of a solid sphere of mass 10 kg and radius 0.5 m , rotating about an axis 0.2 m from the centre of the sphere .



[Watch Video Solution](#)

12. A disc of moment of inertia $20 \text{ kg} \cdot \text{m}^2$ is rotated about its transverse symmetry axis at 120 rpm by an electric motor of power 62.84 watts. When the motor is switched off, how many rotations does it complete before coming to rest ?



[Watch Video Solution](#)

13. A flywheel rotating about an axis through its centre and perpendicular to its plane loses $10\pi^2$ J of energy on slowing down from 60 rpm to 30 rpm. Find its moment of inertia about the given axis and the change in its angular momentum.



Watch Video Solution

14. A particle performs SHM of amplitude 10 cm. Its maximum velocity during oscillations is

100 cm/s. What is its displacement, when the velocity is 60 cm/s ?



[Watch Video Solution](#)

15. A particle performs linear SHM with amplitude 5 cm and period 2s. Find the speed of the particle at a point where its acceleration is half the maximum acceleration.



[Watch Video Solution](#)

16. The amplitude and the periodic time of a S.H.M. are 5 cm and 6 sec respectively. At a distance of 2.5 cm away from the mean position, the phase will be



Watch Video Solution

17. A coil of insulate copper wire is connected to a galvanometer. What will happen if a bar magnet is (i) pushed into the coil, (ii)

withdrawn from inside the coil, (iii) held stationary inside the coil ?



[Watch Video Solution](#)

18. A steel needle of length 5 cm can stay afloat on water . Find the weight of the needle . [Surface tension of water = 0.07 N/m]



[Watch Video Solution](#)

19. A car moving at 40 km/h passes a factory which is sounding a siren of frequency 500 Hz. What does the frequency appear to the driver of the car before and after passing by the factory?



[View Text Solution](#)

20. Two persons A and B are standing on a road. A third person riding on a cycle between A and B is ringing his bell and moving towards

A at 27 km/h. The frequency of the bell as heard by A is 420 Hz. What is the frequency of the bell as heard by B ?



[View Text Solution](#)

21. The speed of a transverse wave along a uniform metal wire, when it is under a tension of 1 kg wt, is 68 m/s . If the density of the metal is 7900 Kg/m^3 . Find the area of cross section of the wire.



[View Text Solution](#)

22. A closed pipe and an open pipe sounding together produce 5 beats per second. If the length of the open pipe is 30 cm, find by how much the length of the closed pipe should be changed to bring the two pipes in unison. Take speed of sound in air is 330 m/s.



Watch Video Solution

23. In melde's experiment, the number of loops on the string changes from 5 to 4 , when the

tension in the string is increased by 0.018 gm wt, then the initial tension in the string will be



[Watch Video Solution](#)

24. Calculate the internal energy of one mole of a diatomic gas at 300 K. Assume the molecules to be rigid.



[Watch Video Solution](#)