Question Bank

Q1: Grandfather clocks are decorative clocks with a pendulum measuring out the passing of a second. How long of a pendulum is needed to have a period of 1 second?
Use 9.8 m/s^2 for the acceleration due to gravity.

Ans: $T = 2\pi\sqrt{\frac{L}{g}}$

Square both sides to get rid of the radical

$$T^2 = 4\pi^2 \frac{L}{g}$$

Multiply both sides by g

$$T^2 g = 4\pi^2 L$$

Divide each side by 4π

$$L = \frac{T^2 g}{4\pi^2}$$

Plug in the values for the period and gravity.

$$L = \frac{(1\ s)^2(9.8\ m/s^2)}{4\pi^2} L = \frac{9.8\ m}{4\pi^2}$$

L = 0.25 m

Q2/ A ball of mass 2kg is attached to a string of length 4m, forming a pendulum. If the string is raised to have an angle of 30 degrees below the horizontal and released, what is the velocity of the ball as it passes through its lowest point?

Ans: 6.3 m/s

Q3/A pendulum has a period of 5 seconds. If the length of the string of the pendulum is quadrupled, what is the new period of the pendulum?

Ans/ 10s

Q4/ A student studying Newtonian mechanics in the 19th century was skeptical of some of Newton's concepts. The student has a pendulum that has a period of 3 seconds while sitting on his desk. He attaches the pendulum to a ballon and drops it off the roof of a university building, which is 20m tall. Another student realizes that the pendulum strikes the ground with a velocity of 12ms. What is the period of the pendulum as it is falling to the ground?

Ans/ 5s

Q5/A pendulum of mass m has a period T. If the mass is quadrupled to 4m, what is the new period of the pendulum in terms of T?

Ans/T

Q6/ A pendulum of length 10m will take how long to complete one period of its swing?

Ans/ 6.3s

Q7/A pendulum of length 2.5m has a mass of 15kg attached to the bottom. Determine the frequency of the pendulum if it is released from a shallow angle.

Ans/1.98 s-1

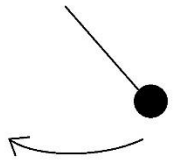
Q8/How will increasing the mass at the end of a pendulum change the period of it's motion? Assume a shallow angle of release.

Ans/There will be no change

Q9/If a simple pendulum is set to oscillate on Earth, it has a period of Te. Now suppose this same pendulum were moved to the Moon, where the gravitational field is 6 times less than that of Earth. What is the period Tm of this pendulum on the Moon in terms of Te?

Ans/ Te$\sqrt{6}$

Q10/Consider the diagram of a pendulum shown below.



As the pendulum swings back and forth, which of the following values is at its maximum when the pendulum is at the bottom of its line of motion?

Ans/Kinetic energy

Q11/Which simple pendulum will have a longer period?

$A : m = 10 \text{ kg}, L = 2 \text{ m}$

$B : m = 4 \text{ kg}, L = 3 \text{ m}$

$g = 10 \ \frac{\text{m}}{\text{s}^2}$

Ans/ because it has a longer length

Q12/ A simple pendulum of length $L = 0.6\ \mathrm{m}$ with a block of mass $m = 5\ \mathrm{kg}$ attached has a maximum velocity of $1.2\ \frac{\mathrm{m}}{\mathrm{s}^2}$. What is the maximum height of the block?

ANS/$0.07\ \mathrm{m}$

Q13/ A simple pendulum with a length of $L = 2\ \mathrm{m}$ has a block of mass $m = 6\ \mathrm{kg}$ attached to the end. If the pendulum is $h = 1\ \mathrm{m}$ above its lowest point and rotating downward, what is the instantaneous acceleration of the block?

Ans/5m/s^2

Q14/A block of mass $m = 8\ \mathrm{kg}$ is attached to a rigid pole of length $L = 2\ \mathrm{m}$. If the block has a velocity of $4\ \frac{\mathrm{m}}{\mathrm{s}}$ as it travels through the horizontal, what is the distance between the blocks lowest and highest points? Neglect the mass of the pole. Neglect air resistance and any frictional forces.

Ans/2.8m

Q15/ rigid rod of length $L = 4\ \mathrm{m}$ has a block of mass $m = 25\ \mathrm{kg}$ attached to one end and is allowed to rotate as a simple pendulum from the other end. What is the lowest maximum velocity of the block that will allow the block to rotate in complete circles?

Ans/12.6m/s

Q16/A simple pendulum of length $L = 4\ \mathrm{m}$ has a block of mass $m = 10\ \mathrm{kg}$ attached to the end of it. The pendulum is originally at an angle of $\theta = 5^\circ$θ=5∘ to the vertical and at rest. If the pendulum is released and allowed to rotate freely at time $t = 0$t=0, what is the angle of the pendulum at time $t = 10\ \mathrm{s}$?

Ans/ 4.5 degree

Q17/A simple pendulum of length $L = 2.5\ \mathrm{m}$ has a block attached to one end which has a maximum velocity of $12.5\ \frac{\mathrm{m}}{\mathrm{s}}$. What is the minimum velocity of the block?

Ans/ 7.5m/s

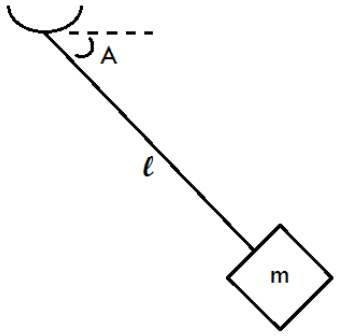
Q18/A simple pendulum has a length $L = 1.4\ \mathrm{m}$ has a block of mass $m = 6\ \mathrm{kg}$ attached to one end. If the pendulum is released from rest, what is the maximum centripetal acceleration felt by the block?

Ans/ 20m/s^2

Q19/A simple pendulum with a length $L = 4\ \mathrm{m}$ has a block attached to one end that has maximum velocity of $v = 8\ \frac{\mathrm{m}}{\mathrm{s}}$. At what angle to the vertical does the block have a velocity of $4\ \frac{\mathrm{m}}{\mathrm{s}^2}$?

Ans/ 66.4

Q20/Consider the following system:



If the length of the pendulum is 2m and the maximum velocity of the block is 3ms, what is the minimum possible value of angle A?

g=10ms2

ANS/50.8 DEGREE

Q21/Matt Damon is once again trapped on Mars. He must measure the length of rope he has using only a stopwatch. Please solve the problem below.

A pendulum on Mars has been measured to have a period of 5.3 seconds. Using the knowledge that gravity on Mars is 3.711ms2 determine the length of the simple pendulum. Round to 3 significant figures

ANS/ 2.64M

Q22/What is the acceleration due to gravity in a region where a simple pendulum having a length 75.000 cm has a period of 1.7357 s?

Q23/The viscosity of liquid

Answer: B. Decreases with increase in temperature

Q24/What is the relation between the viscosities of blood and water?

Answer: D. Blood is more viscous than water.

Q25/The factor on which viscosity depends is _____

A. Area of contact of two adjacent layers

B. Velocity difference between two adjacent layers

C. The distance between two adjacent layers

D. All of the mentioned

Answer: D. All of the mentioned

Q26/ What is the SI unit of viscosity?

Answer: A. Poiseiulle