

Q.48

Angle of friction is angle between _____.

- a) the incline and horizontal
- b) the normal reaction and friction force
- c) the weight of the body and friction force
- d) normal reaction and the resultant of normal reaction and friction force

Q.49

The force of friction developed at the contact surface is always _____.

- a) parallel to the plane and along the direction of the applied force
- b) perpendicular to the plane
- c) parallel to the plane and opposite to the direction of motion
- d) all the above

Q.50 The maximum inclination of the plane on which the body free from external forces remains at rest is _____.
 a) cone of friction b) angle of friction
 c) angle of repose d) none of the above

Q.51 The force of friction depends on _____.
 a) area of contact b) roughness of the surfaces
 c) both (a) and (b) d) none of the above

Q.52 The maximum frictional force developed when a body just begins to slide over the surface of another body is _____.
 a) sliding friction b) rolling friction
 c) limiting friction d) none of the above

Q.53 The angle which an inclined surface makes with the horizontal when a body placed on it is on the verge of moving down is called _____.
 a) angle of repose b) angle of friction
 c) angle of inclination d) none of the above

Q.54 Frictional force is independent of _____.
 a) coefficient of friction b) angle of friction
 c) shape and size of surface of contact

Q.55 Compared to static friction, kinetic friction is _____.
 a) greater b) smaller c) very large d) zero

Q.56 Coefficient of friction (μ) is given by _____.
 a) $\mu = FR$ b) $\mu = \frac{F}{R}$ c) $\mu = \frac{R}{F}$ d) $\mu = F^2$

Q.57 If ϕ = angle of friction and μ = coefficient of friction, then _____.
 a) $\mu = \tan \phi$ b) $\tan \phi = \frac{1}{\mu}$ c) $\sin \phi = \mu$ d) $\cos \phi = \mu$

Q.58 If ϕ = angle of friction and θ = angle of repose then _____.
 a) $\phi = \frac{1}{\theta}$ b) $\phi = \theta$ c) $\phi = \tan \theta$ d) $\theta = \tan \phi$

- Q.59** Force of friction developed at a contact surface is _____.
 a) opposite to the direction of motion b) along the direction of motion
 c) perpendicular to the plane d) all the above
- Q.60** The angle of friction is given by
 a) $\phi = \sin^{-1}(\mu)$ b) $\phi = \cos^{-1}(\mu)$ c) $\phi = \tan^{-1}(\mu)$ d) $\phi = \cot^{-1}(\mu)$
- Q.61** At impending motion _____.
 a) body is about to move b) frictional force is maximum
 c) frictional force is equal to tangential applied force
 d) all the above
- Q.62** When a body resting on a rough horizontal surface is subjected to a horizontal force and the body remains at rest, the frictional force $F_r =$
 a) $\mu_s N$ b) $\mu_k N$ c) applied force d) none of the above
- Q.63** Coulomb's laws of friction are applicable to _____.
 a) two solid surfaces in contact b) two fluid layers
 c) a fluid layer and a solid surface d) none of the above
- Q.64** Force required to start motion is _____.
 a) less than the force required to maintain motion
 b) more than the force required to maintain motion
 c) equal to the force required to maintain motion d) none of the above
- Q.65** If the force applied on the object to just move it is kept constant, the object _____.
 a) moves with constant velocity b) retards
 c) accelerates d) none of the above
- Q.66** If an object is moving with constant velocity then the frictional force is _____.
 a) $\mu_s N$ b) $\mu_k N$
 c) equal to applied force d) both (b) and (c)
- Q.67** If a plane is inclined at the angle of repose and an object placed on it is given a velocity of 1 m/s down the plane, the object _____.
 a) moves with constant velocity b) retards
 c) accelerates d) none of the above

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- Q.68** If a block of weight W rests on a rough plane inclined at angle θ , the frictional force is _____.
a) $\mu_s W \sin \theta$ b) $\mu_s W \cos \theta$ c) $W \sin \theta$ d) $W \cos \theta$
- Q.69** Block B is kept on block A which in turn is kept on a horizontal surface. If A is suddenly accelerated towards right, the frictional force on B will be _____.
a) directed towards right b) directed towards left
c) zero d) vertical
- Q.70** Block B is kept on block A which in turn is kept on a horizontal surface. A horizontal force is applied towards right on A but A does not move. The frictional force on B will be _____.
a) directed towards right b) directed towards left.
c) zero d) vertical
- Q.71** If a block of weight W moves down a rough inclined plane inclined at angle θ with constant velocity, the frictional force is _____.
a) $\mu_k W \sin \theta$ b) $W \sin \theta$ c) $W \cos \theta$ d) none of the above
- Q.72** A block is placed on an inclined plane. The angle θ of the plane is such that the block slides down with constant velocity. The coefficient of kinetic friction is _____.
a) $\sin \theta$ b) $\cos \theta$ c) g d) $\tan \theta$
- Q.73** A block of weight W is held against a vertical wall by applying a horizontal force F . The minimum value of F needed to hold the block is _____.
a) less than W b) equal to W c) more than W d) none of the above
- Q.74** When a body is moving the force of friction is known as _____.
a) static friction b) limiting friction c) rolling friction d) kinetic friction
- Q.75** Which of the following is correct ?
a) $\mu_s < 0$ b) $0 < \mu_s < 1$ c) $\mu_s > 0$ d) none of the above
- Q.76** Which of the following statements is correct ?
a) Friction always opposes motion
b) Friction can be in the direction of motion
c) Friction cannot be in the direction of motion
d) None of the above.

- Q.77** We cannot move on a perfectly smooth surface due to _____.
 a) absence of normal reaction ✓b) absence of friction
 c) both (a) and (b) d) none of the above
- Q.78** A heavy trolley with wheels can be pushed more easily compared to a box of the same weight as _____.
 a) area of contact with the ground is less for the trolley
 b) normal reaction on the wheels is less
 ✓c) rolling friction is less than sliding friction
 d) none of the above
- Q.79** The unit of coefficient of friction is _____.
 a) N b) N/m c) $N \cdot m$ ✓d) none of the above
- Q.80** The equation $F_r = \mu_s N$ can be used when _____.
 a) object is moving b) object is static
 ✓c) motion is impending d) none of the above
- Q.81** The larger tension T_2 and the smaller tension T_1 in the belt on two sides of a pulley are related as
 ✓a) $\frac{T_2}{T_1} = e^{\mu\beta}$ b) $\frac{T_1}{T_2} = e^{\mu\beta}$ c) $\frac{T_2}{T_1} = e^{\mu/\beta}$ d) $\frac{T_1}{T_2} = e^{\frac{\mu}{\beta}}$
- Q.82** If T_1 and T_2 are tensions in the belt on two sides of a pulley of radius r with $T_2 > T_1$, the torque on the pulley is _____.
 a) $\frac{(T_2 - T_1)}{r}$ ✓b) $(T_2 - T_1)r$ c) $(T_2 - T_1)^2 r$ d) $(T_2 - T_1)r^2$
- Q.83** Belt friction is used to _____.
 a) drive the pulley
 ✓c) both (a) and (b)
 b) stop the pulley
 d) none of the above
- Q.84** If belt drives the pulley, the driving torque and rotation of pulley _____.
 ✓a) have same sense of rotation
 c) are independent of each other
 b) have opposite sense of rotation
 d) none of the above
- Q.85** In breaking mechanisms, the driving torque and rotation of pulley _____.
 a) have same sense of rotation
 c) are independent of each other
 ✓b) have opposite sense of rotation
 d) none of the above

d) the vertical components of reactions are zero

Q.103 A body just begins sliding on a horizontal surface when a force of 100 N is applied parallel to the surface. If the body is pulled with a horizontal force of 50 N, the frictional force will be _____.

- a) zero b) 100 N c) 50 N d) 5 N

Q.104 When a bicycle is in motion and is not being pedalled, the frictional force exerted by the ground on the bicycle is _____.

- a) in the backward direction on the front wheel and in the forward direction on the rear wheel
b) in the forward direction on the front wheel and in the backward direction on the rear wheel
 c) in the backward direction on both the front and the rear wheels
d) in the forward direction on both the front and the rear wheels

Q.105 When a bicycle is in motion and is being pedalled, the frictional force exerted by the ground on the bicycle is _____.

- a) in the backward direction on the front wheel and in the forward direction on the rear wheel
b) in the forward direction on the front wheel and in the backward direction on the rear wheel
c) in the backward direction on both the front and the rear wheels
d) in the forward direction on both the front and the rear wheels

- Q.106** A man is moving towards right. The direction of frictional force exerted by the ground on the man's feet is in _____.
 a) backward b) forward c) upward d) downward
- Q.107** If a man moving towards right exerts a normal force of 100 N on the ground and $\mu_s = 0.3$ and $\mu_k = 0.2$, the frictional force exerted on the man's feet by the ground is _____.
 a) 20 N towards left b) 20 N towards right
 c) 30 N towards left d) 30 N towards right
- Q.108** A block of weight 100 N is placed on a plane surface inclined at 20° with the horizontal. If $\mu_s = 0.3$ and $\mu_k = 0.2$, the block will _____.
 a) slide down with constant velocity b) remain stationary
 ✓c) slide down with constant acceleration d) move upward
- Q.109** A block of weight 100 N is placed on a plane surface inclined at 20° with the horizontal. If $\mu_s = 0.3$ and $\mu_k = 0.2$, the frictional force on the block is _____.
 ✓a) 18.8 N upward along the incline b) 18.8 N downward along the incline
 c) 28.2 N upward along the incline d) 28.2 N downward along the incline
- Q.110** A block of weight 100 N is placed on a plane surface inclined at 10° with the horizontal. If $\mu_s = 0.3$ and $\mu_k = 0.2$, the block will _____.
 a) slide down with constant velocity ✓b) remain stationary
 c) slide down with constant acceleration d) move upwards
- Q.111** A block of weight 100 N is placed on a plane surface inclined at 10° with the horizontal. If $\mu_s = 0.3$ and $\mu_k = 0.2$, the frictional force acting on the block is _____.
 a) $0.3 \times 100 \cos 30^\circ$ N ✓b) $0.2 \times 100 \cos 30^\circ$ N
 c) $100 \sin 10^\circ$ N d) 0
- Q.112** A block of weight 50 N is kept on a wooden plank and the inclination of the plank with the horizontal is slowly increased. If $\mu_s = 0.2$ and $\mu_k = 0.1$, the angle at which the block starts sliding down is _____.
 ✓a) $\tan^{-1} 0.2$ b) $\tan^{-1} 0.1$ c) $\sin^{-1} 0.2$ d) $\sin^{-1} 0.1$

- Q.113** A block of weight 100 N is kept on a plane surface inclined at 10° to the horizontal. If $\mu_s = 0.3$ and $\mu_k = 0.2$, the force P applied parallel to the plane, required to keep the block static is _____.

- a) 75.98 N b) 67.32 N c) 50 N d) 0

- Q.114** A block of weight 100 N is kept on a plane surface inclined at 10° to the horizontal. If $\mu_s = 0.3$ and $\mu_k = 0.2$, and a force P is applied parallel to the plane to keep the block static, the frictional force on the block is _____.

- a) 25.98 N b) 17.36 N c) 50 N d) 0

- Q.115** A block of weight 100 N is kept on a plane surface inclined at 10° to the horizontal. If $\mu_s = 0.3$ and $\mu_k = 0.2$, the force P applied parallel to the plane required to move the block upwards along the plane is _____.

- a) 46.9 N b) 37.1 N c) 100 N d) 50 N

- Q.116** A block of mass 50 kg is kept on a plane surface inclined at an angle of 30° with horizontal. If $\phi_k = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$, and the block is given an initial velocity of 1 m/s, the block will _____.

- a) slide down with constant velocity of 1 m/s
 b) slide down with constant acceleration
 c) decelerate and stop after some time
 d) none of the above

$$\phi_k = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right) = 30^\circ$$

$$\phi_k = d = 30^\circ$$

- Q.117** A right circular cylinder of weight 50 N, radius of base 25 mm and height 50 mm rests on a horizontal surface. If $\mu_s = 0.3$ and $\mu_k = 0.2$, the force required to slide the cylinder is _____.

- a) 10 N b) 15 N c) 20 N d) 25 N

$$f_r = 0.3 \times 50 = 15N$$

- Q.118** A right circular cylinder of weight 50 N, radius of base 25 mm and height 50 mm rests on a horizontal surface. If $\mu_s = 0.3$ and $\mu_k = 0.2$, and a force P is applied horizontally at the top of the cylinder. The value of P at which the cylinder topples is _____.

- a) 10 N b) 15 N c) 20 N d) 25 N

- Q.119** A block of weight 100 N is kept on a rough horizontal surface for which $\mu_s = 0.3$ and $\mu_k = 0.2$. If a horizontal force of 20 N is applied to the block, the magnitude of frictional force is _____.

- a) 20 N b) 30 N c) 40 N d) 0

- Q.120** A block of weight 100 N is kept on a rough horizontal surface for which $\mu_s = 0.3$ and $\mu_k = 0.2$. If a horizontal force of a magnitude of 40 N is applied to the block, the magnitude of frictional force will be _____.
 $\Sigma F_x = 40N$
 $\mu mg - 0.3 \times 100 = 20N$
 $\mu = 0.2 \times 100 = 20N$
- a) 20 N b) 30 N c) 40 N d) 0
- Q.121** A block of weight 100 N is kept on a rough horizontal surface for which $\mu_s = 0.3$ and $\mu_k = 0.2$. A horizontal force of 20 N is applied to the block then the block _____.
 $\Sigma F_x = 20N$
 $\mu mg - 0.3 \times 20 = 20N$
- a) slides with constant velocity b) slides with constant acceleration
c) remain static d) any one of the above
- Q.122** A block of weight 100 N is kept on a rough horizontal surface for which $\mu_s = 0.3$ and $\mu_k = 0.2$. A horizontal force of 40 N is applied to the block then the block _____.
 $\Sigma F_x = 40N$
 $\mu mg - 0.3 \times 100 = 20N$
 $F_{max} < \Sigma F_x$
Body moves
- a) slides with constant velocity b) slides with constant acceleration
c) remains static d) any one of the above
- Q.123** A right circular cylinder of weight 50 N, radius of base 25 mm and height 50 mm rests on a horizontal surface. If $\mu_s = 0.3$ and $\mu_k = 0.2$ and a horizontal force of 20 N is applied at the top of the cylinder, it _____.
 $\Sigma F_x = 20N$
 $\mu mg - 0.3 \times 50 = 15N$
 $F_{max} < \Sigma F_x$
Slides
- a) slides b) topples
c) slides and topples d) neither slides nor topples
- Q.124** A right circular cylinder of weight 50 N, radius of base 25 mm and height 50 mm rests on a horizontal surface. If $\mu_s = 0.3$ and $\mu_k = 0.2$. If the horizontal force applied at the top of the cylinder is 10 N, the cylinder _____.
 $\Sigma F_x = 10N$
 $\mu mg - 0.3 \times 50 = 15N$
- a) slides b) topples
c) slides and topples d) neither slides nor topples
- Q.125** A right circular cylinder of weight 100 N, radius of base 50 mm and height 250 mm rests on a horizontal surface. A horizontal force P is applied at the top of the cylinder. If $\mu_s = 0.3$ and $\mu_k = 0.2$, the magnitude of P for which the cylinder slides is _____.
 $P - \mu mg$
For sliding
- a) 20 N b) 30 N c) 40 N d) 50 N
- Q.126** A right circular cylinder of weight 100 N, radius of base 50 mm and height 250 mm rests on a horizontal surface. A horizontal force P is applied at the top of the cylinder. If $\mu_s = 0.3$ and $\mu_k = 0.2$, the magnitude of P for which the cylinder topples is _____.
 $P - \mu mg$
For toppling
- a) 20 N b) 30 N c) 40 N d) 50 N

Q.127 A right circular cylinder of weight 100 N, radius of base 50 mm and height 250 mm rests on a horizontal surface. A horizontal force P is applied to the cylinder. $\mu_s = 0.3$ and $\mu_k = 0.2$. If the magnitude of P is 25 N, the maximum height at which it can be applied so that toppling of the cylinder is prevented is _____.
 a) 250 mm b) 200 mm c) 150 mm d) 100 mm

$$100 \times 50 = 100 \sin 30 h \\ h = 100 \text{ mm}$$

Q.128 A right circular cylinder of weight 100 N, radius of base 50 mm and height 200 mm is kept on a plane surface inclined at an angle of 30° with the horizontal. If $\mu_s = 0.7$, the cylinder _____. $W \sin \theta = 0.7 \times 100 \cos 30 = 60.621$
 a) slides down with constant velocity
 b) slides down with constant acceleration
 c) overturns
 d) neither slides nor overturns

Q.129 A right circular cylinder of weight 100 N, radius of base 50 mm and height 150 mm is kept on a plane surface inclined at an angle of 30° with the horizontal. If $\mu_s = 0.7$, the cylinder _____. $\mu_s g = 0.7 \times 100 = 70 \text{ N}$
 a) slides down with constant velocity
 b) slides down with constant acceleration
 c) overturns
 d) neither slides nor overturns

$$2f_{\max} = 100 \sin 30 = 50 \text{ N}$$

$f_x < f_{\max}$: Body at rest

Q.130 A right circular cylinder of weight 100 N, radius of base 50 mm and height 'h' is kept on plane surface inclined at an angle of 30° with the horizontal. If $\mu_s = 0.7$, the minimum height of the cylinder for which it overturns is _____. $100 \sin 30 h = 100 \cos 30 \times 50$
 a) $\frac{50}{\sqrt{3}}$ mm b) $50\sqrt{3}$ mm c) $\frac{100}{\sqrt{3}}$ mm d) $100\sqrt{3}$ mm

$$86.602$$

Q.131 A 100 N block is pulled on a rough horizontal surface by a 30 N force with a constant velocity of 2 m/s. The frictional force on the block is _____.
 a) 100 N b) 70 N c) 30 N d) data is not sufficient to find the frictional force

As constant velocity $\Rightarrow a = 0$
 Body at rest

Q.132 A heavy block is to be supported against a vertical wall by inserting a wedge under it. The direction of frictional force on the wedge from the wall is _____.
 a) upward b) downward c) horizontal
 d) inclined at 45° with horizontal

Q.133 A heavy block is to be raised against a vertical wall by inserting a wedge under it. The direction of frictional force on the block from the wall is _____.

- a) upward b) downward c) horizontal
d) inclined at 45° with horizontal

Q.134 A block of weight 500 N is hanging from a rope which passes over a fixed rod of circular cross section. A horizontal force P is applied at the other end of the rope. If $\mu_s = 0.2$ and $\mu_k = 0.1$, the horizontal force P required to support the block is _____.

- a) $500 e^{0.1\pi}$ b) $500 e^{-0.1\pi}$ c) $500 e^{0.05\pi}$ d) $500 e^{-0.05\pi}$

Q.135 A block of weight 500 N is hanging from a rope which passes over a fixed rod of circular cross section. A horizontal force P is applied at the other end of the rope. If $\mu_s = 0.2$ and $\mu_k = 0.1$ and the block is to be pulled upwards, the minimum force P is _____.

- a) $500 e^{0.1\pi}$ b) $500 e^{-0.1\pi}$ c) $500 e^{0.05\pi}$ d) $500 e^{-0.05\pi}$

Q.136 A block of weight 500 N is hanging from a rope which passes over a fixed rod of circular cross section. A horizontal force P is applied at the other end of the rope. If $\mu_s = 0.2$ and $\mu_k = 0.1$ and the block is to be lowered with constant velocity, the magnitude of force P is _____.

- a) $500 e^{0.1\pi}$ b) $500 e^{-0.1\pi}$ c) $500 e^{0.05\pi}$ d) $500 e^{-0.05\pi}$

Q.137 A block of weight 500 N is hanging from a rope which passes over a fixed rod of circular cross section. A horizontal force P is applied at the other end of the rope. If $\mu_s = 0.2$ and $\mu_k = 0.1$ and the block is to be raised upward with constant velocity, the magnitude of force P is _____.

- a) $500 e^{0.1\pi}$ b) $500 e^{-0.1\pi}$ c) $500 e^{0.05\pi}$ d) $500 e^{-0.05\pi}$