Practice Sheet

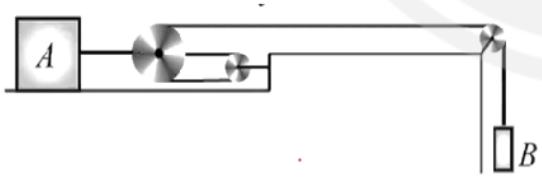
Physics by Saleem Sir

LAWS OF MOTION

Q1 A block of mass $2\ \text{kg}$ rests on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of static friction between the block and the plane is 0.7 . The frictional force on the block is-
(A) 0.7×9.8 Newton
(B) 9.8 Newton
(C) $0.7 \times 9.8\sqrt{3}$ Newton
(D) $9.8 \times \sqrt{3}$ Newton

Q2 A $150\ \text{g}$ tennis ball coming at a speed of $40\ \text{m/s}$ is hit straight back by a bat to a speed of $60\ \text{m/s}$. The magnitude of the average force F on the ball, when it is in contact for $5\ \text{ms}$ with the bat is:
(A) $2500\ \text{N}$
(B) $3000\ \text{N}$
(C) $3500\ \text{N}$
(D) $4000\ \text{N}$

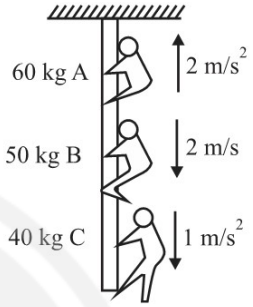
Q3 If block A has a velocity of $0.6\ \text{m/s}$ to the right. Determine the velocity of block B.



(A) $1.8\ \text{m/s}$ in downward direction
(B) $1.8\ \text{m/s}$ in upward direction
(C) $0.6\ \text{m/s}$ in downward direction
(D) $0.6\ \text{m/s}$ in upward direction

Q4 A ball of mass $0.15\ \text{kg}$ hits the wall with an initial speed of $12\ \text{ms}^{-1}$ and bounces back without changing its initial speed. If the force applied by the wall on the ball during the contact is $100\ \text{N}$, calculate the time during the contact of ball with the wall.
(A) $0.018\ \text{s}$ (B) $0.036\ \text{s}$
(C) $0.009\ \text{s}$ (D) $0.072\ \text{s}$

Q5 Tension in the rope at the rigid support is: (g = 10 m/s^2)



(A) 760 N
(B) 1360 N
(C) 1580 N
(D) 1620 N

Q6 A bullet of mass $10\ \text{g}$ leaves the barrel of gun with a velocity of $600\ \text{m/s}$. If the barrel of the gun is $50\ \text{cm}$ long and mass of gun is $3\ \text{kg}$, then value of impulse supplied to the gun will be:
(A) $12\ \text{Ns}$ (B) $6\ \text{Ns}$
(C) $36\ \text{Ns}$ (D) $3\ \text{Ns}$

Q7 A block of mass $5kg$ is placed at rest on a table of rough surface. Now, if a force of $30N$ is applied in the direction parallel to surface of the table, the block slides through a distance of $50m$ in an interval of time $10s$. Coefficient of kinetic friction is (given, $g = 10ms^{-2}$):
(A) 0.60 (B) 0.75
(C) 0.50 (D) 0.25

Q8 A machine gun of mass $10\ \text{kg}$ fires $20\ \text{g}$ bullets at the rate of 180 bullets per minute with a speed of$100\ \text{ms}^{-1}$ each. The recoil velocity of the gun is:

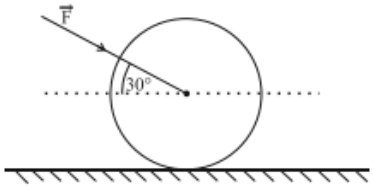
(A) $0.02\ \mathrm{m/s}$ (B) $2.5\ \mathrm{m/s}$
(C) $1.5\ \mathrm{m/s}$ (D) $0.6\ \mathrm{m/s}$

Q9 A balloon and its content having mass M is moving up with an acceleration ' a '. The mass that must be released from the content so that the balloon starts moving up with an acceleration '3a ' will be
(Take ' g ' as acceleration due to gravity)
(A) $\frac{3Ma}{2a+g}$ (B) $\frac{3Ma}{2a-g}$
(C) $\frac{2Ma}{3a+g}$ (D) $\frac{2Ma}{3a-g}$

Q10 An engine of mass $5 \times 10^4\ \mathrm{kg}$ pulls a coach of mass $4 \times 10^4\ \mathrm{kg}$. Suppose that there is a resistance of $1\ \mathrm{N}$ per $100\ \mathrm{kg}$ acting on both coach and engine, and that the driving force of engine is $4500\ \mathrm{N}$. The acceleration of the engine and tension in the coupling will respectively be
(A) $0.04\ \mathrm{m/s^2}, 2000\ \mathrm{N}$
(B) $0.4\ \mathrm{m/s^2}, 200\ \mathrm{N}$
(C) $0.4\ \mathrm{m/s^2}, 20\ \mathrm{N}$
(D) $4\ \mathrm{m/s^2}, 200\ \mathrm{N}$

Q11 A block of mass M slides down on a rough inclined plane with constant velocity. The angle made by the inclined plane with horizontal is θ. The magnitude of the contact force will be:
(A) Mg
(B) $Mg\cos\theta$
(C) $\sqrt{Mg\sin\theta + Mg\cos\theta}$
(D) $Mg\sin\theta\sqrt{1+\mu}$

Q12 As shown in figure, a $70\ \mathrm{kg}$ garden roller is pushed with a force of $\overrightarrow{F} = 200\ \mathrm{N}$ at an angle of 30° with horizontal. The normal reaction on the roller is (Given g=10 ms^{-2})

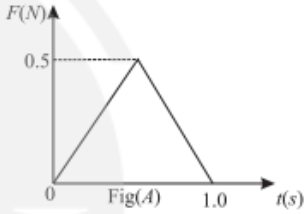


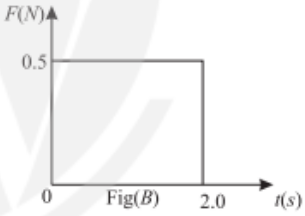
(A) $800\sqrt{2}N$ (B) $600\ \mathrm{N}$
(C) $800\ \mathrm{N}$ (D) $200\sqrt{3}N$

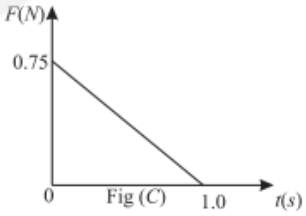
Q13 A balloon has mass of $10\ \mathrm{g}$ in air. The air escapes from the balloon at a uniform rate with velocity $4.5\ \mathrm{cm/s}$. If the balloon shrinks in $5\ \mathrm{s}$ completely. Then, the average force acting on the balloon will be (in dyne).
(A) 3 (B) 9
(C) 12 (D) 18

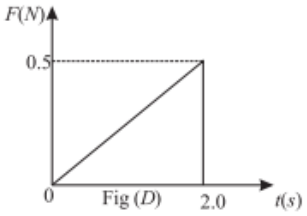
Q14 At any instant, the velocity of a particle of mass $500\ \mathrm{g}$ is $\left(2t\hat{i} + 3t^2\hat{j}\right)\ \mathrm{ms^{-1}}$. If the force acting on the particle at $t = 1\ \mathrm{s}$ is $\left(\hat{i} + x\hat{j}\right)N$. Then the value of x will be:
(A) 3 (B) 4
(C) 6 (D) 2

Q15 Figures (A),(B),(C) and (D) show variation of force with time.



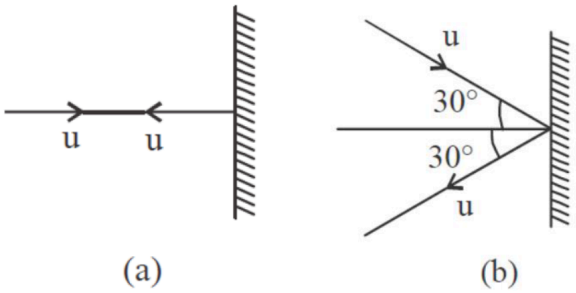






The impulse is highest in which figure ?
(A) Fig (C) (B) Fig (B)
(C) Fig (A) (D) Fig (D)

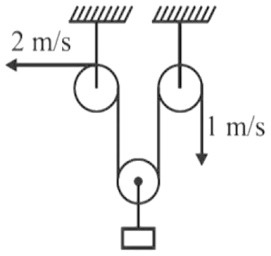
Q16 What is the direction of force on the wall due to the ball in two cases shown in the figures?



(A) In (a) force is normal to the wall and in (b) force is inclined at 30° to the normal.
(B) In (a) force is normal to the wall and in (b) force is inclined at 60° to the normal.
(C) In (a) the force is along the wall and in (b) force is normal to the wall.
(D) In (a) and (b) both, the force is normal to the wall.

Q17 A block of mass m slides down an inclined plane inclined at angle 30° with an acceleration $\frac{g}{4}$. The value of coefficient of kinetic friction will be:
(A) $\frac{2\sqrt{3}+1}{2}$
(B) $\frac{1}{2\sqrt{3}}$
(C) $\frac{\sqrt{3}}{2}$
(D) $\frac{2\sqrt{3}-1}{2}$

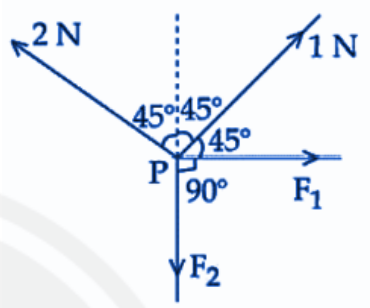
Q18 Find the velocity of the hanging block if the velocities of the free ends of the rope are as indicated in the figure.



(A) $3/2\ \mathrm{m/s} \uparrow$
(B) $3/2\ \mathrm{m/s} \downarrow$
(C) $1/2\ \mathrm{m/s} \uparrow$
(D) $1/2\ \mathrm{m/s} \downarrow$

Q19 A small ball of mass m is thrown upward with velocity u from the ground. The ball experiences a resistive force mkv^2, where v is its speed. The maximum height attained by the ball is
(A) $\frac{1}{2K}\tan^{-1}\frac{ku^2}{g}$ (B) $\frac{1}{K}\ln\left(1+\frac{ku^2}{2g}\right)$
(C) $\frac{1}{2K}\ln\left(1+\frac{ku^2}{g}\right)$ (D) $\frac{1}{K}\tan^{-1}\frac{ku^2}{2g}$

Q20 Four forces are acting at a point P in equilibrium as shown in figure. The ratio of force F_1 to F_2 is $1:x$ Where $x =$ ____.



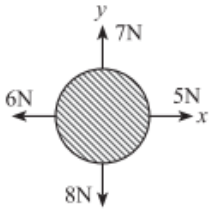
(A) 2 (B) 3
(C) 6 (D) 9

Q21 In two different experiments, an object of mass $5\ \mathrm{kg}$ moving with a speed of $25\ \mathrm{ms^{-1}}$ hits two different walls and comes to rest within (i) 3 second, (ii) 5 seconds, respectively. Choose the correct option out of the following:
(A) Impulse and average force acting on the object will be same for both the cases.
(B) Impulse will be same for both the cases but the average force will be different.
(C) Average force will be same for both the cases but the impulse will be different.
(D) Average force and impulse will be different for both the cases.

Q22 A force $\vec{F} = \left(40\hat{i} + 10\hat{j}\right)N$ acts on a body of mass $5\ \mathrm{kg}$. If the body starts from rest, its position vector $\vec{r}$ at time $t = 10\ \mathrm{s}$, will be:
(A) $\left(100\hat{i} + 100\hat{j}\right)m$ (B) $\left(400\hat{i} + 100\hat{j}\right)m$
(C) $\left(400\hat{i} + 400\hat{j}\right)m$ (D) $\left(100\hat{i} + 400\hat{j}\right)m$

Q23 For a free body diagram shown in the figure, four forces are applied in the ' x ' and ' y ' directions.

What additional force must be applied and at what angle with positive x-axis so that the net acceleration of body is zero?



(A) $\sqrt{2}$ N, 45°

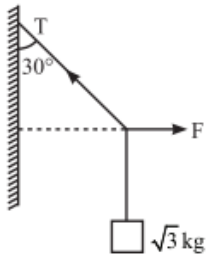
(B) $\sqrt{2}$ N, 135°

(C) $\frac{2}{\sqrt{3}}$ N, 30°

(D) 2 N, 45°

Q24 A block of $\sqrt{3}$ kg is attached to a string whose other end is attached to the wall. An unknown force F is applied so that the string makes an angle of 30° with the wall. The tension T in the string is:

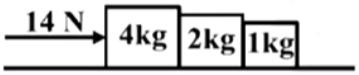
$(\text{Given } g = 10 \text{ ms}^{-2})$



(A) 20 N (B) 25 N

(C) 10 N (D) 15 N

Q25 Three blocks of masses 4 kg, 2 kg and 1 kg respectively are in contact on a frictionless table as shown in the figure. If a force of 14 N is applied on the 4 kg block, the contact force between the 4 kg and the 2 kg block will be



(A) 2 N

(B) 6 N

(C) 8 N

(D) 14 N

Q26 A body of mass m collides head on, elastically with velocity u with another identical body at rest. After collision, velocity of the second body will be

(A) zero

(B) u

(C) 2u

(D) Data insufficient

Q27 A frame will be inertial, if it moves with respect to another inertial frame with a constant :-

(A) Linear velocity

(B) Angular velocity

(C) Linear acceleration

(D) All of the above

Q28 How much Pseudo force will act on a mass of 3 kg as observed from a reference frame of a person of 5 kg moving with acceleration of 2 m/s^2 in right direction?

(A) 10 N toward left

(B) 10 N towards right

(C) 6 N towards right

(D) 6 N towards left

Q29 Which one of the following motions on a smooth plane surface does **not** involve force?

(A) Accelerated motion in a straight line.

(B) Retarded motion in a straight line.

(C) Motion with constant momentum along a straight line.

(D) Motion along a straight line with varying velocity.

Q30 A block of mass 2 kg rests on a rough inclined plane making an angle of 30° with the horizontal.The coefficient of static friction between the block and the plane is 0.7. The frictional force on the block is

(A) 0.7×9.8 Newton

(B) 9.8 Newton

(C) $0.7 \times 9.8\sqrt{3}$ Newton

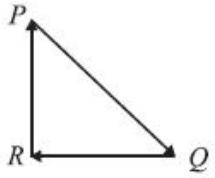
(D) $9.8 \times \sqrt{3}$ Newton

Q31 An open knife edge of mass 200 g is dropped from height 5 m on a cardboard. If the knife edge penetrates a distance of 2 m into the cardboard,

the average resistance offered by the cardboard to the knife edge is

(A) 7 N (B) 25 N
(C) 35 N (D) 20 N

Q32 A particle moving with non zero velocity is acted by three forces shown by the vector triangle *PQR*. The velocity of the particle will



(A) Change according to the smallest force $\overrightarrow{QR}$
(B) Increase
(C) Decrease
(D) Remain constant

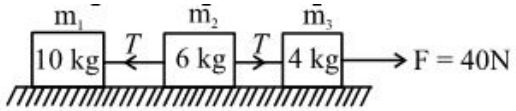
Q33 An object flying in air with velocity $\left(20\hat{i}+25\hat{j}-12\hat{k}\right)$ suddenly breaks in two pieces whose masses are in the ratio 1 : 5. The smaller mass flies off with a velocity $\left(100\hat{i}+35\hat{j}+8\hat{k}\right)$. The velocity of the largest piece will be

(A) $4\hat{i}+23\hat{j}-16\hat{k}$
(B) $-100\hat{i}-35\hat{j}-8\hat{k}$
(C) $20\hat{i}+15\hat{j}-80\hat{k}$
(D) $-20\hat{i}-15\hat{j}-80\hat{k}$

Q34 A lift is moving down with acceleration '***a***'. A man in the lift drops a ball inside the lift. The acceleration of the ball as observed by the man in the lift and a man standing stationary on the ground are respectively

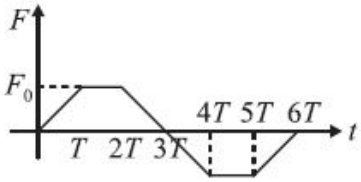
(A) g. g (B) g - a, g - a
(C) g - a, g (D) a, g

Q35 Three blocks of masses m_1, m_2 and m_3 are placed on a horizontal frictionless surface. A force of 40 N pulls the system, then calculate the value of T, if m_1 = 10 kg, m_2 = 6 kg, m_3 = 4 kg.



(A) 40 N (B) 20 N
(C) 10 N (D) 5 N

Q36 A particle of mass *m* experiences a force that varies with time as shown. If the particle was at rest at $t = 0$. Find the velocity of the particle at the end of time $t = 3T$.



(A) $2TF_0$ (B) $\frac{TF_0}{m}$
(C) $\frac{2TF_0}{m}$ (D) $\frac{3F_0T^2}{2m}$

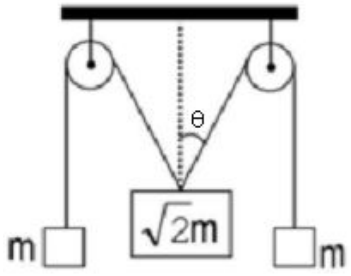
Q37 A body of mass 2 kg travels according to the law $x(t) = pt + qt^2 + rt^3$(in m), where p = 3 m/s, q = 4 m/s^2 and r = 5 m/s^3
.The force acting on the body at $t = 2$ s is

(A) 136 N (B) 134 N
(C) 158 N (D) 68 N

Q38 Two bodies of masses 6 kg and 3 kg are tied to the ends of a string, which passes over a fixed pulley of the Atwood's machine. The total downward thrust on the pulley is nearly

(A) $5 \times 9.8\ N$
(B) $6 \times 9.8\ N$
(C) $7 \times 9.8\ N$
(D) $8 \times 9.8\ N$

Q39 The pulleys and strings shown in the figure are smooth and of negligible mass. For the system to remain in equilibrium, the angle θ should be



(A) 0° (B) 30°
(C) 45° (D) 60°

Q40

A body under the action of a force $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}\ \text{N}$ acquires an acceleration of 1 m/s^2. The mass of this body must be

(A) $2\sqrt{10}\ \text{kg}$ (B) $10\ \text{kg}$

(C) $20\ \text{kg}$ (D) $10\sqrt{2}\ \text{kg}$

Q41 A boat of mass 300 kg moves according to the equation x = 1.2 t^2 – 0.2 t^3 (x is in m). When will the force become zero?

(A) 2 s (B) 1 s

(C) 6 s (D) 2.8 s

Q42 A 60 kg boy stands on a scale in the elevator. The elevator starts moving and records 450 N. Find the acceleration of the elevator.

(A) 2.5 ms^{-2} upward

(B) 2.5 ms^{-2} downward

(C) 2.5 ms^{-2} in either direction

(D) None of these

Q43 A mass of 1 kg is suspended by a thread. It is

1. lifted up with an acceleration 4.9 m/s^2,
2. Lowered with an acceleration 4.9 m/s^2,

The ratio of the tensions is

(A) 3:1 (B) 1:3

(C) 1:2 (D) 2:1

Q44 **Assertion (A):** The weighing machine measures the reaction on the surface of weighing machine by the weight of a body.

Reason (R): Weightlessness means the absence of mass.

(A) Both **Assertion (A)** and **Reason (R)** are true and **Reason (R)** is a correct explanation for Assertion(A) .

(B) Both **Assertion (A)** and **Reason (R)** are true but **Reason (R)** is not a correct explanation of **Assertion (A).**

(C) **Assertion (A)** is true and **Reason (R)** is false.

(D) **Assertion (A)** is false and **Reason (R)** is true.

Q45 Match the columns.

	Column I		**Column II**
	(Quantity)		**(SI unit)**
I.	Impulse	p.	N
II.	Normal Reaction	q.	N-s
III.	Coefficient of friction	r.	Unitless
IV.	Force of kinetic friction	s.	N/s

I II III IV

(1) q p r p

(2) p q p r

(3) q q p r

(4) r r q q

(A) 1 (B) 2

(C) 3 (D) 4

Answer Key

Q1	(B)
Q2	(B)
Q3	(A)
Q4	(B)
Q5	(C)
Q6	(B)
Q7	(C)
Q8	(D)
Q9	(C)
Q10	(A)
Q11	(A)
Q12	(C)
Q13	(B)
Q14	(A)
Q15	(B)
Q16	(D)
Q17	(B)
Q18	(A)
Q19	(C)
Q20	(B)
Q21	(B)
Q22	(B)
Q23	(A)
Q24	(A)
Q25	(B)
Q26	(B)
Q27	(A)
Q28	(D)
Q29	(C)
Q30	(B)
Q31	(A)
Q32	(D)
Q33	(A)
Q34	(C)
Q35	(B)
Q36	(C)
Q37	(A)
Q38	(D)
Q39	(C)
Q40	(D)
Q41	(A)
Q42	(B)
Q43	(A)
Q44	(C)
Q45	(A)