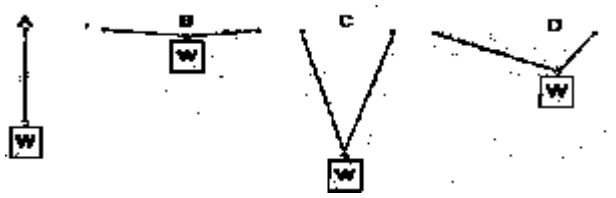
Dear student following is a Moderate level [○ ○ ● ○ ○] test paper. Score of 18 Marks in 10 Minutes would be a satisfactory performance. Questions 1-10 (+3, –1). (All Questions have Single Options correct)

Q.1 A weight can be hung in any of the following four ways. In which case is the string most likely to break ?



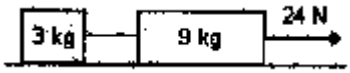
(A) A (B) B (C) C (D) D

Q.2 A force F acts on a body of mass 1 kg moving in straight line with an initial velocity u for 1s, then
(A) Distance covered by the body is u + F/2
(B) Momentum of the body increase by F
(C) Final velocity of the body is u + F
(D) All of these

Q.3 A 1,200 kilogram car travelling at 10 metres per second hits a tree and is brought to rest in 0.1 second. What is the magnitude of the average force acting on the car to bring it to rest ?
(A) 1.2×10^2 N (B) 1.2×10^3 N
(C) 1.2×10^4 N (D) 1.2×10^5 N

Q.4 A 50 kg woman standing on an accurate bathroom weight scale in an elevator that is accelerating upward at 2.8 m/s^2 . What is the reading on the scale, in kilograms ?
(A) 64.3 kg (B) 54.3 kg
(C) 46.5 kg (D) 74.5 kg

Q.5 Two boxes are accelerated to the right on a frictionless horizontal surface as shown. The larger box has a mass of 9 kilograms and the smaller box has a mass of 3 kilograms. If a 24 newton horizontal force pulls on the larger box, with what force does the larger box pull on the smaller box ?



(A) 3 N (B) 6 N (C) 8 N (D) 18 N

Q.6 The momentum of a certain body is given by P(t) = 5t + 3 (kg. m/s). Here denotes time. Find the force acting on the body at t = 10 sec.
(A) 0 N (B) 5 N (C) 3 N (D) None

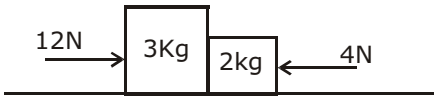
Q.7 A stream of a liquid of density ρ flowing horizontally with a speed v gushes out of a tube of radius r and hits at a vertically wall nearly normally. Assuming that the liquid does not rebound from the wall, the force exerted on the wall by the impact of liquid is given by
(A) $\pi r\rho v$ (B) $\pi r\rho v^2$ (C) $\pi r^2\rho v$ (D) $\pi r^2\rho v^2$

Q.8 An object is kept on a smooth inclined plane of 1 in ℓ. The horizontal acceleration to be imparted to the inclined plane so that the object is stationary relative to the incline is given by

(A) $g\sqrt{\ell^2 - 1}$ (B) $g(\ell^2 - 1)$

(C) $\frac{g}{\sqrt{\ell^2 - 1}}$ (D) $\frac{g}{\ell^2 - 1}$

Two blocks of mass 3 kg and 2 kg are on frictionless table next to each other. Two forces are applied in opposite directions to the two blocks as shown.



Q.9 What is the magnitude of the acceleration of the system ?
(A) a = 2.0 m/s^2 (B) a = 3.0 m/s^2
(C) a = 3.2 m/s^2 (D) a = 1.6 m/s^2

Q.10 What is the magnitude of the force F_{32} that the 3 kg block exerts on the 2 kg block ?
(A) F_{32} = 8.00 N (B) F_{32} = 12 N
(C) 4.00 < F_{32} < 8.00 N (D) None

PHYSICS IIT JEE (JULY 1st WEEK CLASS TEST 2) (NLM) ANSWER KEY

Name : ..... **Roll No. :** .....

	A	B	C	D		A	B	C	D		A	B	C	D
1	○	○	○	○	4	○	○	○	○	7	○	○	○	○
2	○	○	○	○	5	○	○	○	○	8	○	○	○	○
3	○	○	○	○	6	○	○	○	○	9	○	○	○	○
										10	○	○	○	○

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	B	A	D	A	B	B	D	C	D	C

SOLUTIONS

Sol.1 (B)

Sol.2 (A)

Change in momentum = (F) (t) = F (t = 1s)

Since mass of the body is 1 kg hence change in velocity is also F or the final velocity of the body will be μ + F.

Acceleration , $a = \frac{F}{m} = F.$

$\therefore \quad S = ut + \frac{1}{2} at^2 = u + \frac{1}{2}F \quad (t = 1s)$

Sol.3 (D)

Impulse = change in momentum,

$I = \Delta p$ or $Ft = mv.$

We are given m, v and t.

Putting the values in the equation and solve for F.

$F \times 0.10 = 1200 \times 10$

or $F = 1.2 \times 10^5 N$

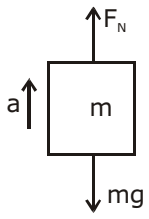
Sol.4 (A)

The scale measures F_N

$F_N - mg = ma$

$F_N = m (g + a)$

$F_N = 50 (2.8 + 9.8) = 630 N$



Scale reading $= \frac{F_N}{g} = \frac{630}{9.8} = 64.3$ kg

Sol.5 (B)

Acceleration

$$a = \frac{F}{m_1 + m_2}$$

$$= \frac{24}{3+9} = \frac{24}{12} = 2 \text{ m/s}^2$$

Tension

$T = m_1$

$= 3kg \times 2m/s^2 = 6N.$

Sol.6 (B)

Momentum $P(t) = 5t + 3$

Force $F(t) = \frac{dp(t)}{dt}$

$F(t) = 5 \times 1 + 0$

$F_{t=10} = 5N$

Sol.7 (D)

Cross-sectional area of tube (A) = πr^2

Since the speed of the liquid is v, the volume of liquid flowing out per second = $Av = \pi r^2 v$

Mass of liquid flowing out per second = $\pi r^2 v \rho$

Therefore,

Initial momentum of liquid per second

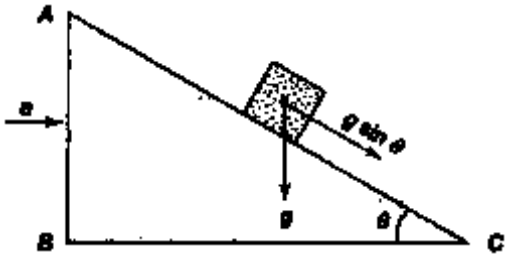
= mass of liquid flowing per second × speed of liquid

= $\pi r^2 v^2 \rho$

This is the rate at which momentum is imparted to wall on impact. Since the liquid does not rebound after impact, the momentum after impact is zero. Hence, the rate of change of momentum = $\pi r^2 v^2 \rho$.

From Newton's second law, the force exerted on the wall = rate of change of momentum $\pi r^2 v^2 \rho$.

Sol.8 (C)



Refer to fig. Given AB = 1, AC = ℓ, so that BC = $\sqrt{\ell^2 - 1}$. Thus $\tan\theta$ = AB/BC = $1/\sqrt{\ell^2 - 1}$.

A horizontal acceleration a imparted to the inclined plane has a component $a\cos\theta$ down the plane. If this equals the component $g \sin\theta$ of the g along the plane, the object will appear stationary relative to the incline, i.e. if $a \cos\theta = g \sin\theta$

or $a = g \tan\theta = \frac{g}{\sqrt{\ell^2 - 1}}$

Sol.9 (D)

Total force on the system

$F_t = 12\ N - 4\ N = 8\ N$

The acceleration a of the bodies

$$a = \frac{F_{total}}{\text{total mas}} = \frac{8}{3+2} = 1.6\ m/s^2$$

Sol.10 (C)

The magnitude of the force F_{32} that 3 kg block exerts on the 2 kg block.

= acceleration × 3kg

$$= 1.6\ \frac{m}{s^2} \times 3\ kg$$

$F_{32} = 4.8\ N$