Dear student following is a Moderate level [O O ● O O] test paper. Score of 15 Marks in 10 Minutes would be a satisfactory performance. Questions 1-8 (+3, –1). (All Questions have Single Options correct)

Q.1 When a force of 1N acts on a body of mass 1 gram, the body receives an acceleration of

(A) 1 ms^{-2} (B) 9.8 ms^{-2}

(C) 980 ms^{-2} (D) 1000 ms^{-2}

Q.2 A body of mass m has its position x at a time t expressed by the equation $x = 3t^{3/2} + 2t^{-1/2}$. The instantaneous force on the body is proportional to

(A) t^0 (B) $t^{-1/2}$

(C) t (D) $t^{3/2}$

Q.3 A body of weight W_1 is suspended from the ceiling of a room through a chain of weight W_2. The earth pulls the chain by a force equal to

(A) W_1 (B) $(W_1 + W_2)/2$

(C) $(W_1 + W_2)$ (D) $W_1 \times W_2$

Q.4 A boy of mass 40 kg wants to climb up a rope hanging vertically. The rope can withstand a maximum tension of 500 N. What is the maximum acceleration with which the boy can climb the rope ?

(Take g = 10 ms^{-2}).

(A) 1.5 ms^{-2} (B) 2.0 ms^{-2}

(C) 2.5 ms^{-2} (D) 3.0 ms^{-2}

Q.5 A object is gently placed on a long conveyer belt moving with a speed of 5 ms^{-1}. If the coefficient of friction between the block and the belt is 0.5, the block will slid on the belt up to a distance

(Take g = 10 ms^{-2})

(A) 2.0 m (B) 2.5 m

(C) 3.0 m (D) 3.5 m

Q.6 A boy of mass m is sliding down a vertical pole by pressing it with a horizontal force f. If μ is the coefficient of friction between his palms and the pole, the acceleration with which he slides down will be

(A) g (B) $\frac{\mu f}{m}$

(C) $g + \frac{\mu f}{m}$ (D) $g - \frac{\mu f}{m}$

The following questions consist of two statements one labelled Assertion (A) and the another labelled Reason (R). Select the correct answers to these questions from the codes given below :

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is not correct explanation of A

(C) A is true but R is false

(D) A is false but R is true.

Q.7 **Assertion** : Friction is a self adjusting force.

Reason : The magnitude of static friction is equal to the applied force and its direction is opposite to that of the applied force.

Q.8 **Assertion** : A large brake on a bicycle wheel is more effective than a small one.

Reason : Force of friction is independent of the surface area of contact.

PHYSICS IIT JEE (JULY 2nd WEEK CLASS TEST 2) (NLM & FRICTION) 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	○	○	○	○					

ANSWER KEY

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

SOLUTIONS

Sol.1 (D)

$$a = \frac{F}{m} = \frac{1N}{(0.001)kg} = 1000\ ms^{-2}$$

Sol.2 (B)

$x = 3t^{3/2} + 2t^{-1/2}$. Hence, velocity

$$v = \frac{dx}{dt} = \frac{9}{2}t^{1/2} - 2 \times \frac{1}{2}t^{-3/2}$$

and acceleration

$$a = \frac{dv}{dt} = \frac{9}{2} \times \frac{1}{2}t^{-1/2} + \frac{3}{2}t^{-5/2}$$

$$= \frac{9}{4}t^{-1/2} + \frac{3}{2}t^{-5/2}$$

i.e. $a \propto t^{-1/2}$, since $t^{-5/2}$ is a small quantity in comparison to $t^{-1/2}$ and it can be neglected.

Sol.3 (C)

Earth pulls the body as well as chain, hence total pulling force = $W_1 + W_2$

Sol.4 (C)

Let a be the maximum acceleration with which the boy should climb the rope. Then, the tension in the rope will be

$$T_{max} = m\ (g + a)$$

But, $T_{max} = 500$ N. Therefore,

$$500 = 40 \times (10 + a)$$

Which gives $a = 2.5\ ms^{-2}$.

Sol.5 (B)

The force of friction between the block and the belt is $f = \mu mg$, where m is the mass of the object. This force produces an acceleration of the block which is given by

$$a = \frac{force}{mass} = \frac{\mu mg}{m} = \mu g$$

The block will slide on the belt without slipping until its speed (v) becomes equal to the speed of the belt. Since u = 0, we have

$$v^2 = 2as$$

or $$s = \frac{v^2}{2a} = \frac{v^2}{2\mu g} = \frac{(5)^2}{2 \times 0.5 \times 10} = 2.5\ m$$

Sol.6 (D)

Normal reaction R = f.

Therefore, force of friction = $\mu R = \mu f$.

The net downward force $F = mg - \mu f$

Hence, the acceleration

$$a = \frac{F}{m} = \frac{mg - \mu f}{m} = g - \frac{\mu f}{m}$$

Sol.7 (D)

Static friction alone is a self adjusting force and not all types of friction.

Sol.8 (D)

The assertion is false, through the reason is true. Infect, large brake on a bicycle wheel is as effective as a small brake. This is because friction force does not depend upon the actual area of contact, so long as normal reaction is the same.