

Dear student following is a Moderate level [0 0 ● 0 0] test paper. Score of 15 Marks in 10 Minutes would be a satisfactory performance. Questions 1-9 (+3, -1). (All Questions have Single Options correct)

- Q.1** Maximum value of static friction is called  
 (A) Limiting friction  
 (B) Rolling friction  
 (C) Normal reaction  
 (D) Coefficient of friction
- Q.2** Work done by a frictional force is  
 (A) Negative (B) Positive  
 (C) Zero (D) All of the above

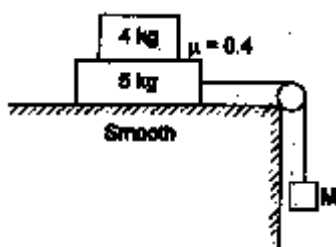
- Q.3** A 3 kg mass is hung on one side of the frictionless Atwood's machine shown, and a 4 kg mass is hung on the other side. Pulley and rope are massless. The acceleration of the masses is



- (A) 1.4 m/s<sup>2</sup> (B) 2.5 m/s<sup>2</sup>  
 (C) 3.3 m/s<sup>2</sup> (D) 7.4 m/s<sup>2</sup>
- Q.4** What is the tension in the rope in the Atwood's machine problem above?  
 (A) 28 N (B) 34 N (C) 36 N (D) 39 N

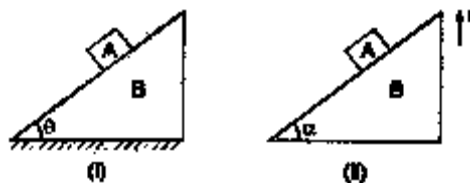
- Q.5** A child pulls horizontally on a box placed on level ground with a force of 20 N, but the box does not move. If the box weight 40 N, then which statement is true about the coefficient of static friction  $\mu_s$  between the box and the ground?  
 (A)  $\mu_s = 0.5$  (B)  $\mu_s \geq 0.5$   
 (C)  $\mu_s \leq 0.5$  (D)  $\mu_s = 2.0$

- Q.6** What should be the maximum value of M so that the 4 kg block does not slip over the 5 kg block.



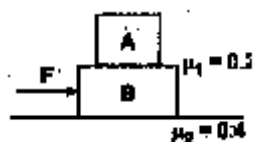
- (A) 12 kg (B) 8 kg (C) 10 kg (D) 6 kg

- Q.7** In case (i) wedge B is stationary and block A starts sliding, when the angle of incline is greater than  $\theta$ . While in case (ii) wedge B is moving upwards with an acceleration  $a$  and the block starts sliding when the angle of incline is greater than  $\alpha$ , then :



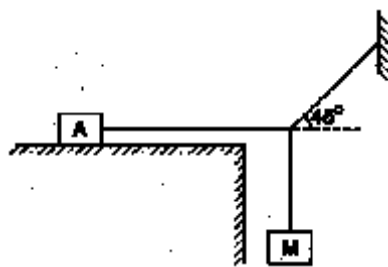
- (A)  $\theta = \alpha$  (B)  $\theta > \alpha$   
 (C)  $\theta < \alpha$  (D)  $\frac{\tan \theta}{\tan \alpha} = \frac{g}{a}$

- Q.8** In the figure,  $m_A = 2$  kg and  $m_B = 4$  kg. For what minimum value of F, A starts slipping over B ( $g = 10$  m/s<sup>2</sup>)



- (A) 24 N (B) 36 N (C) 12 N (D) 20 N

- Q.9** Mass of block A is 10 kg. Coefficient of friction between the block A and surface is 0.3. What is the maximum values of M for which system remains in equilibrium ( $g = 10$  m/s<sup>2</sup>)



- (A) 2 kg (B) 6 kg (C) 3 kg (D) 5 kg

PHYSICS IIT JEE (JULY 1<sup>ST</sup> WEEK CLASS TEST 3) (NLM) ANSWER KEY

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

	A	B	C	D		A	B	C	D		A	B	C	D
1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	8	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	9	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**ANSWER KEY**

<b>Que.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
<b>Ans.</b>	A	D	A	B	B	D	A	B	C

## SOLUTIONS

**Sol.1 (A)**

**Sol.2 (D)**

Work done by friction can be positive, negative and zero depending upon the situation.

**Sol.3 (A)**

$$T - 3g = 3a \text{ or } T = 3g + 3a \dots (1)$$

$$4g - T = 4a \dots (2)$$

From eq. (1) and (2)

$$4g - 4a = 3g + 3a$$

$$g = 7a$$

$$a = \frac{g}{7} = \frac{9.8}{7} = 1.4 \text{ m/s}^2$$

**Sol.4 (B)**

$$T - 3g = 3a$$

or  $T = 3(g + a)$

$$T = 3(9.8 + 1.4)$$

$$T = 3 \times 11.2$$

$$T = 33.6 = 34 \text{ N}$$

**Sol.5 (B)**

$$f \leq \mu_s F_N \quad \text{or} \quad \mu_s \geq \frac{f}{F_N}$$

$$\mu_s \geq \frac{20}{40} \quad \text{or} \quad \mu_s \geq 0.5$$

**Sol.6 (D)**

Maximum acceleration of 4 kg block could be

$$a = \mu g = 0.4g$$

Now 
$$a = \frac{\text{net pulling Force}}{\text{total mass}}$$

Hence 
$$0.4g = \frac{Mg}{M + 5 + 4}$$

or 
$$0.4 = \frac{M}{9 + M}$$

or 
$$M = 6 \text{ kg}$$

**Sol.7 (A)**

In case (i) sliding starts when :

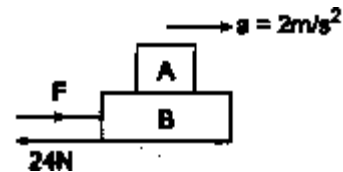
$$g \sin \theta \geq \mu g \cos \theta \text{ or } \tan \theta > \mu$$

While in case (ii) sliding will start when

$$(g + a) \sin \alpha > \mu (g + a) \cos \alpha$$

or  $\tan \alpha > \mu \quad \therefore \alpha = \theta$

**Sol.8 (B)**



Maximum frictional force between A and B could be :

$$f_1 = \mu_1 m_A g = (0.2) (2) (10) \text{ N}$$

$$f_1 = 4 \text{ N}$$

Hence, maximum common acceleration till both the block move with same acceleration is

$$a = \frac{f_1}{m_A} = \frac{4}{2} = 2 \text{ m/s}^2$$

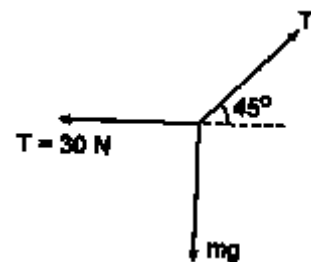
Now, taking (A + B) as the system :

$$(f_2)_{\text{max}} = \mu_2 (m_A + m_B) g = 24 \text{ N}$$

$$F - 24 = (m_A + m_B) a = 6 \times 2 = 12$$

$\therefore F = 36 \text{ N}$

**Sol.9 (C)**



Maximum friction force between block A and surface is:

$$f_{\text{max}} = \mu mg = (0.3) (10) (10) = 30 \text{ N}$$

Therefore, maximum tension in the string connected with block A should be 30 N. Now,

$$T' \cos 45^\circ = 30 \quad \text{---- (1)}$$

$$T' \sin 45^\circ = Mg \quad \text{----- (2)}$$

From equations (1) and (2),  $M = 3 \text{ kg}$