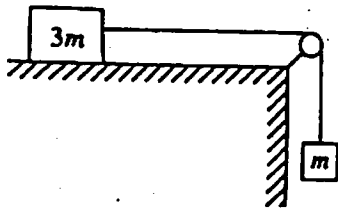


Forces



A block of mass $3m$ can move without friction on a horizontal table. This block is attached to another block of mass m by a cord that passes over a frictionless pulley, as shown above. If the masses of the cord and the pulley are negligible, what is the magnitude of the acceleration of the descending block?

- (A) Zero
- (B) $g/4$
- (C) $g/3$
- (D) $2g/3$
- (E) g

2) Three forces act on an object. If the object is in translational equilibrium, which of the following must be true?

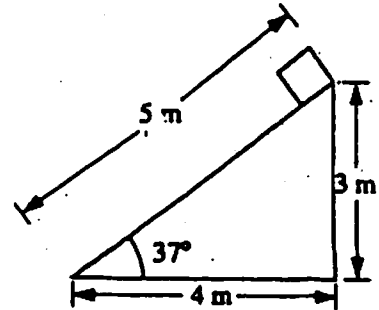
- I. The vector sum of the three forces must equal zero.
- II. The magnitudes of the three forces must be equal.
- III. All three forces must be parallel.

- (A) I only
- (B) II only
- (C) I and III only
- (D) II and III only
- (E) I, II, and III

3) A ball falls straight down through the air under the influence of gravity. There is a retarding force F on the ball with magnitude given by $F = hr$, where r is the speed of the ball and h is a positive constant. The magnitude of the acceleration a of the ball at any time is equal to which of the following?

- (A) $g - h$
- (B) $g - \frac{hr}{m}$
- (C) $g + \frac{hr}{m}$
- (D) $\frac{g}{h}$
- (E) $\frac{hr}{m}$

Questions 4-6



4) A plane 5 meters in length is inclined at an angle of 37° as shown above. A block of weight 20 newtons is placed at the top of the plane and allowed to slide down.

The mass of the block is most nearly

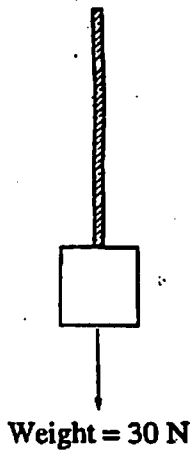
- (A) 1.0 kg
- (B) 1.2 kg
- (C) 1.6 kg
- (D) 2.0 kg
- (E) 2.5 kg

5) The magnitude of the normal force exerted on the block by the plane is most nearly

- (A) 10 N
- (B) 12 N
- (C) 16 N
- (D) 20 N
- (E) 33 N

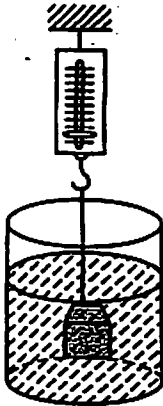
6) The work done on the block by the gravitational force during the 5-meter slide down the plane is most nearly

- (A) 20 J
- (B) 60 J
- (C) 80 J
- (D) 100 J
- (E) 130 J



A rope of negligible mass supports a block that weighs 30 N, as shown above. The breaking strength of the rope is 50 N. The largest acceleration that can be given to the block by pulling up on it with the rope without breaking the rope is most nearly

- (A) 6 m/s²
- (B) 6.7 m/s²
- (C) 10 m/s²
- (D) 15 m/s²
- (E) 16.7 m/s²



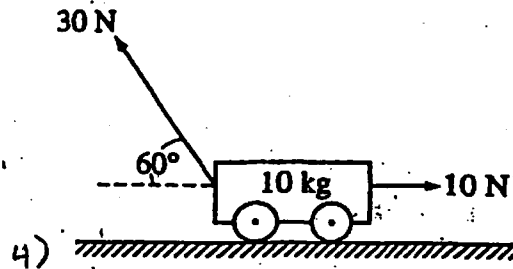
The figure above shows an object of mass 0.4 kg that is suspended from a scale and submerged in a liquid. If the reading on the scale is 3 N, then the buoyant force that the fluid exerts on the object is most nearly

- (A) 1.3 N
- (B) 1.0 N
- (C) 0.75 N
- (D) 0.33 N
- (E) 0.25 N

A weight lifter lifts a mass m at constant speed to a height h in time t . What is the average power of the weight lifter?

- (A) mg
- (B) mh
- (C) mgh
- (D) $mght$
- (E) mgh/t

Forces & Energy

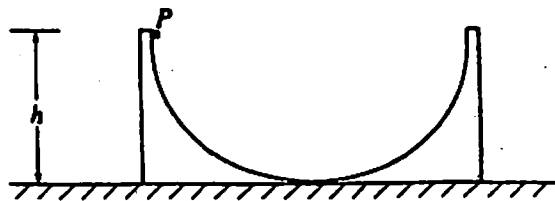


The cart of mass 10 kg shown above moves without frictional loss on a level table. A 10 N force pulls on the cart horizontally to the right. At the same time, a 30 N force at an angle of 60° above the horizontal pulls on the cart to the left. What is the magnitude of the horizontal acceleration of the cart?

- (A) 0.5 m/s²
- (B) 1.6 m/s²
- (C) 2.0 m/s²
- (D) 2.5 m/s²
- (E) 2.6 m/s²

5) A block of mass m slides on a horizontal frictionless table with an initial speed v_0 . It then compresses a spring of force constant k and is brought to rest. How much is the spring compressed from its natural length?

- (A) $\frac{v_0^2}{2g}$
- (B) $\frac{mg}{k} v_0$
- (C) $\frac{m}{k} v_0$
- (D) $\sqrt{\frac{m}{k}} v_0$
- (E) $\sqrt{\frac{k}{m}} v_0$



6) The figure above shows a rough semicircular track whose ends are at a vertical height h . A block placed at point P at one end of the track is released from rest and slides past the bottom of the track. Which of the following is true of the height to which the block rises on the other side of the track?

- (A) It is equal to $h/2\pi$.
- (B) It is equal to $h/4$.
- (C) It is equal to $h/2$.
- (D) It is equal to h .
- (E) It is between zero and h ; the exact height depends on how much energy is lost to friction.