PHYS101-052
MAJOR 1 EXAM

13. A 5.0-kg mass is suspended by a string from the ceiling of an elevator that is moving downward with constant acceleration of 2.8 m/s^2. The tension in the string is:
    A) 49 N
    B) 35 N
    C) 50 N
    D) 12 N
    E) 63 N

14. A 3.0-kg block slides on a frictionless 37° incline plane. A vertical force of 15 N is applied to the block (see Fig 4). The acceleration of the block is:
    A) 3.8 m/s^2 up the incline
    B) 5.9 m/s^2 up the incline
    C) 2.9 m/s^2 down the incline
    D) 8.7 m/s^2 down the incline
    E) 4.4 m/s^2 down the incline

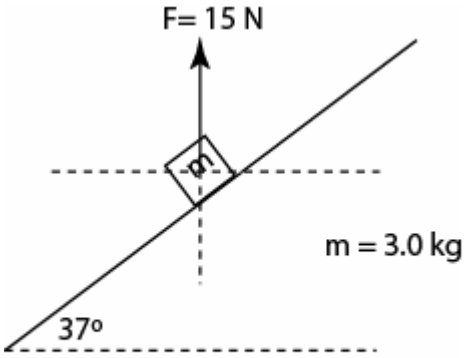

Figure 4

15. Two blocks of mass m_1 = 5.0 kg and m_2 = 10. kg are connected by a massless rod and slide on a frictionless 30° incline as shown in Fig 5. The tension in the rod is:
    A) 38 N
    B) 62 N
    C) 98 N
    D) 49 N
    E) zero

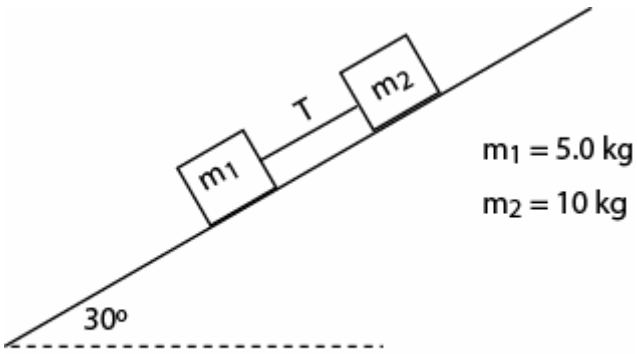

Figure 5

16. A 2.3-N weight is suspended by a string from a ceiling and held at an angle θ from the vertical by 4.0-N horizontal force F as shown in Fig 6. The tension in the string is:
    A) 4.0 N
    B) 0.5 N
    C) 6.3 N
    D) 4.6 N
    E) 1.7 N

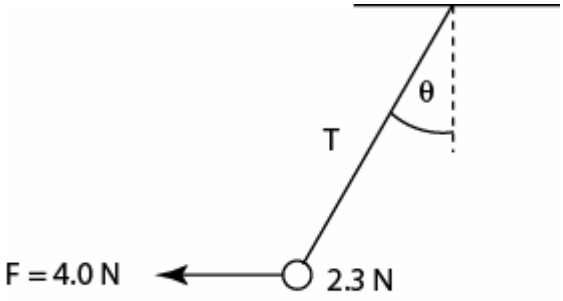

Figure 6

17. A block rests on a rough incline and has coefficients of friction μ_k= 0.20 and μ_s= 0.30. If the incline angle increases, at what angle does the block start moving?
    A) 11.3°
    B) 16.7°
    C) 33.7°
    D) 35.8°
    E) 56.3°

18. A car is moving in a horizontal circular track of radius R=50.0 m. The coefficient of static friction between the car wheels and the track is μ_s= 0.250. What would be the car speed at which the car starts sliding out side the track?
    A) 49.4 m/s
    B) 33.0 m/s
    C) 54.5 m/s
    D) 11.1 m/s
    E) 45.4 m/s

19. A 5.0-kg block is at rest on a rough horizontal surface. The coefficient of static friction between the block and the surface is μ_s= 0.4. If a horizontal force of 15.0 N is acted on the block, what would be the magnitude of the friction force?
    A) 15.0 N
    B) 19.6 N
    C) 12.0 N
    D) 14.0 N
    E) 18.5 N

20. Three equal mass blocks each of mass =2.0 kg can move together over a horizontal frictionless surface. Two forces, $\vec{F}_1 = 40\hat{i}\ N$ and $\vec{F}_2 = -10\hat{i}\ N$ are applied on the three masses system as shown in the Fig 7. The net force on the middle mass is:

A) $-20\hat{i}\ N$

B) $30\hat{i}\ N$

C) $10\hat{i}\ N$

D) $5\hat{i}\ N$

E) $40\hat{i}\ N$

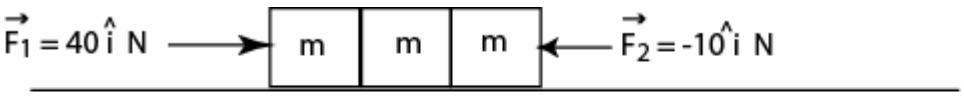

Figure 7

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13. Two forces $\vec{F}_1$ & $\vec{F}_2$ are acting on a 3.0 kg box in the x-y plane. Fig. 3 shows only $\vec{F}_1$ and the acceleration $\vec{a}$ of the box. Find $\vec{F}_2$

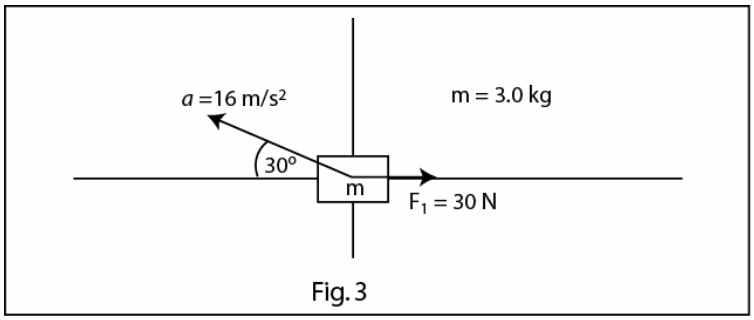

Fig. 3

A) $\left(-36\hat{i} - 48\hat{j}\right)N$

B) $\left(-72\hat{i} - 24\hat{j}\right)N$

C) $\left(72\hat{i} + 24\hat{j}\right)N$

D) $\left(-36\hat{i} - 48\hat{j}\right)N$

E) $\left(-72\hat{i} + 24\hat{j}\right)N$

14. A block of mass m_1=5.7 kg on a frictionless 30° inclined plane is connected by a cord over a massless, frictionless pulley to a second block of mass m_2=3.5 kg hanging vertically as shown in Fig 4. The acceleration of m_2 is:

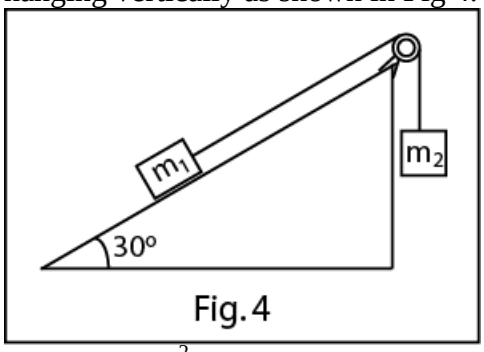

Fig. 4

A) 0.36 m/s^2 downward
B) 0.54 m/s^2 upward
C) 0.69 m/s^2 downward
D) 0.78 m/s^2 upward
E) 0.93 m/s^2 downward

15. Fig.5 shows a block A of mass 6.0 kg and block B of 8.0 kg connected by a rigid rod of negligible mass. Force $\vec{F}_a = (16N)\hat{i}$ acts on block A; force $\vec{F}_b = -(30N)\hat{i}$ acts on block B. The tension (T) in the rod is: (Neglect friction)

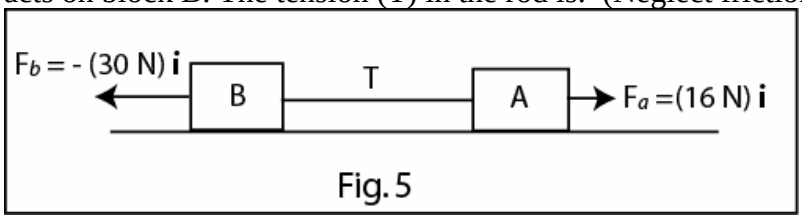

Fig. 5

A) 30 N
B) 22 N
C) 16 N
D) 46 N
E) 14 N

16. A 5.0-kg mass is held at an angle θ from the vertical by a horizontal force F=15 N as shown in Fig 6. The tension (T) in the string supporting the mass (in Newton) is:

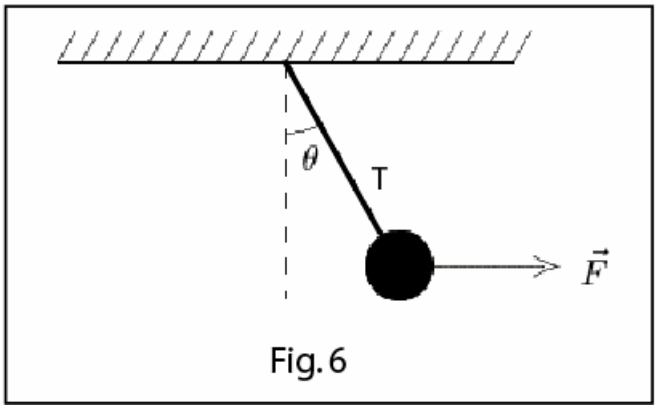

Fig. 6

A) 51
B) 2/ cos θ
C) cos θ/2
D) cos θ
E) 0

17. A 0.20-kg stone is attached to a string and whirled in a circle of radius r = 0.60 m on a horizontal frictionless surface as shown in Fig. 7. If the stone makes 150 revolutions per minute, the tension (T) in the string is:

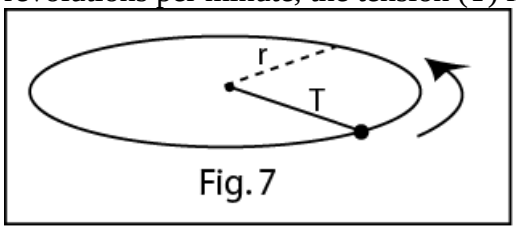

Fig. 7

A) 0.90 N
B) 0.20 N
C) 30 N
D) 1.96 N
E) 0.03 N

18. A block of mass M slides on a horizontal surface. Which of the following would increase the magnitude of the frictional force on the block?
A) None of the other answers
B) Keeping M constant but decreasing the surface area of contact
C) Keeping M constant but increasing the surface area of contact
D) Decreasing M
E) Increasing M

19. A box of mass m is sliding down a rough inclined plane (which makes an angle of 30° with the horizontal and has a coefficient of kinetic friction = μ_k) at a constant acceleration g/4 (where g = 9.8 m/s^2). Find μ_k .
    A) 0.11
    B) 0.16
    C) 2.15
    D) 0.29
    E) 0.64

20. A 5.0 kg block is sliding on a rough horizontal plane (μ_k=0.10) under the effect of a horizontal force F. Fig. 8 shows the velocity (v) of the block as a function of time (t). Calculate F.

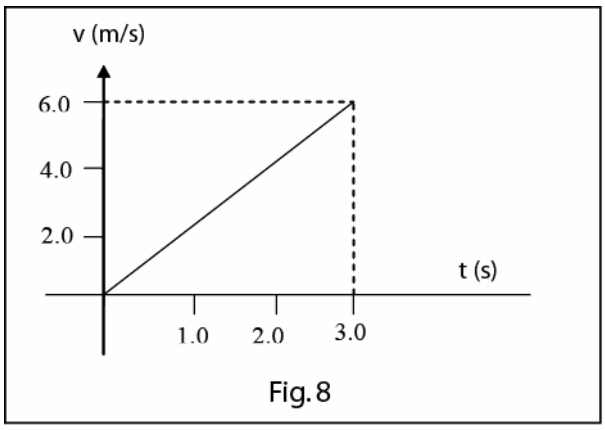

Fig. 8

    A) 30 N
    B) 5.0 N
    C) 10 N
    D) 1.0 N
    E) 15 N