Quiz #4 Ch.#5 T133 Phys101.02-v1

Student ID:..... **Student Name:**.....

Q1. Q16. A 70 N block A and a 35 N block B are connected by a string, as shown in Fig 3. If the pulley is massless and the surface is frictionless, the magnitude of the acceleration of the 35 N block is: A) 3.3 m/s2

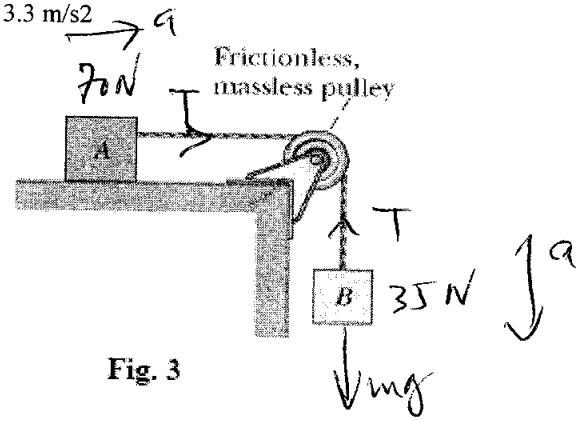


Fig. 3

$$T = \frac{70}{9.8} \times a = 7.14a$$

$$T - 35 = -\frac{35}{9.8}a$$

$$T = 35 - \frac{35}{9.8}a$$

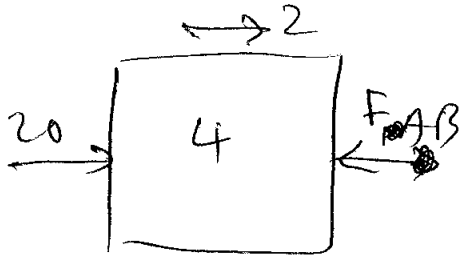
$$= 35 - 3.57a$$

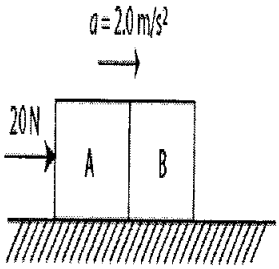
$$T = 35 - 3.57a = 7.14a$$

$$10.71a = 35$$

$$a = \frac{35}{10.71} = 3.3$$

Q#2. Q13. A constant force F of magnitude 20 N is applied to block A of mass m = 4.0 kg, which pushes block B as shown in Fig. 5. The block slides over a frictionless flat surface with an acceleration of 2.0 m/s^2. What is the net force on block B? (Ans:12 N)





$$20 - F_{AB} = 2 \times 4$$

$$F_{AB} = 20 - 8 = 12\ N$$

$$|F_{BA}| = |F_{AB}|$$

Quiz #4 Ch.#5 T133 Phys101.02-v2

Student ID:..... **Student Name:**.....

Q#1. **Q13.** A 4.0 kg block is pushed upward a 30° inclined frictionless plane with a constant horizontal force F (Fig 4). If the block moves with a constant speed find the magnitude of the force F. (A: 23 N)

$$F\cos\theta - mg\sin\theta = 0$$

$$F = mg\frac{\sin\theta}{\cos\theta} = mg\tan\theta$$

$$= 4 \times 9.8 \times \tan 30$$

$$= 22.63\ N \approx 23\ N$$

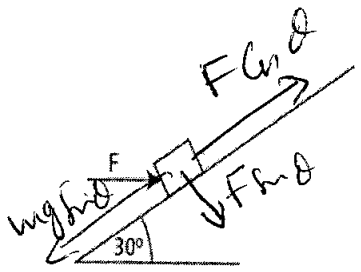


Figure 4

Q#2. A 2.00-*kg* mass is hanging from the ceiling of an elevator accelerating upward at a = 2.50 m/s^2 (see Fig. 6). What is the tension T in the string? (Ans: 24.6 *N*)

$$T - mg = ma$$

$$T = m(g + a)$$

$$= 2 \times (9.8 + 2.50)$$

$$T = 24.6\ N$$

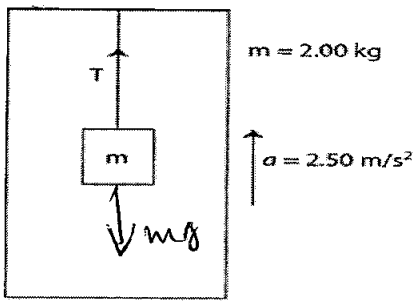


Figure 6

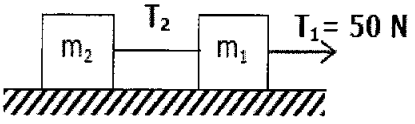
Quiz #4 Ch.#5 **T133** **Phys101.02-v3**

Student ID:..... **Student Name:**.....

Q#1:. Q17: Two masses m1 (= 2.0 kg) and m2 (= 3.0 kg) are connected as shown in Fig 4. Find the tension T2 if the tension T1 = 50.0 N. **(A1)** 30.0 N

$T = (m_1 + m_2)\,a$.

$a = \frac{T}{m_1+m_2} = \frac{50}{2+3} = 10\ m/s^2$



No friction

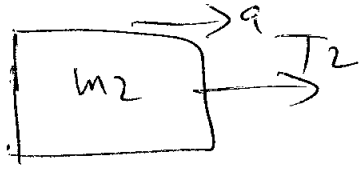


Figure 4

$T_2 = m_2 a = 3 \times 10 = 30\ N$

Q1. . A block of mass m1=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 m2=3.5 kg hanging vertically as shown in Fig 4. The acceleration of m2 is:(Ans: 0.69 m/s downward)

For m_1

$T - m_1 g \sin\theta = m_1 a$

$T = m_1(g \sin\theta + a)$

For m_2

$T - m_2 g = -m_2 a$

$T = m_2(g - a)$

$m_2(g-a) = m_1(g\sin\theta + a)$

$m_2 g - m_1 g \sin\theta = m_1 a + m_2 a = a(m_1 + m_2) \Rightarrow a = \frac{g(m_2 - m_1 \sin\theta)}{m_1 + m_2}$

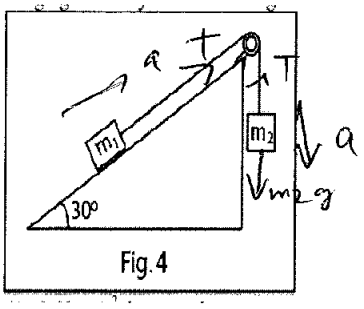


Fig.4

Q14. An elevator cab with a total mass of 2000 kg is pulled upward by a cable. If the elevator accelerates at 2.00 m/s upward, find the tension in the cable. (Ans: 2.36×10^4 N)

$= 9.8\left(\frac{3.5 - 5.7}{5.7+3.5}\right) = 0.69\ m/s$

Quiz #4 Ch.#5 T133 Phys101.02-v4

Student ID:..... **Student Name:**.....

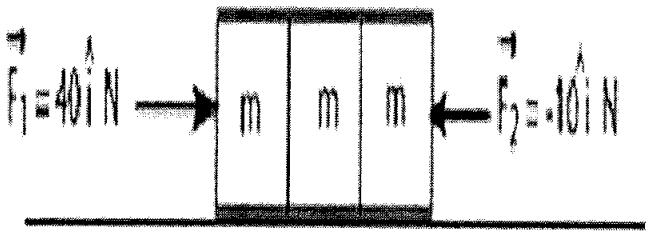
Q2.: **Q#20.** Three equal mass blocks each of mass =2.0 kg can move together over a horizontal frictionless surface. Two forces, $F_1 = 40\,i\,N$ *and* $F_2 = -10\,i\,N$ are applied on the three masses system as shown in the Fig 7. The net force on the middle mass is: (Ans: $10i\,N$)

$40\hat{i} - 10\hat{i} = 6 \times a$

$a = \frac{30\hat{i}}{6} = 5\ m/s^2$

$F_{net} = ma = 2 \times 5$

$= 10\,N\,i$



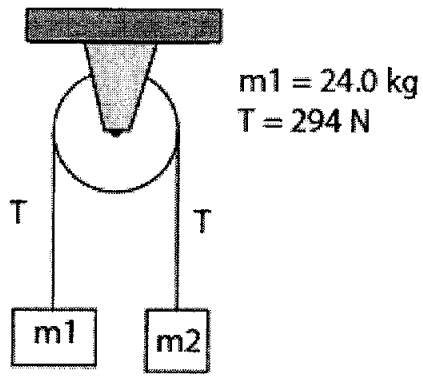
Q1 Two blocks of mass $m_1 = 24.0$ kg and m_2, respectively, are connected by a light string that passes over a massless pulley as shown in Fig. 2. If the tension in the string is T = 294 N. Find the value of m_2. (Ignore friction) (Ans: 40.0 kg)

For m_1

$T - m_1 g = m_1 a$

$a = \frac{T - m_1 g}{m_1} = \frac{294 - 24 \times 9.8}{24}$

$= \frac{294 - 235.2}{24} = 2.45\ m/s$



For m_2

$T - m_2 g = -m_2 a \Rightarrow m_2(g - a) = T$

$m_2 = \frac{T}{g - a}$

$m_2 = \frac{294}{9.8 - 2.45} = 40\ kg$

Quiz #4 Ch.#5 T133 Phys101.02-v5

Student ID:..... **Student Name:**.....

Q2. Q14 :In the system shown in Figure 5, a horizontal force (F) acts on M1(=2.0 kg). If the acceleration of the system has a value of a = 3.5 m/s**2, find the value of (F). (Ignore force of friction). **(A1)** 60.2 N

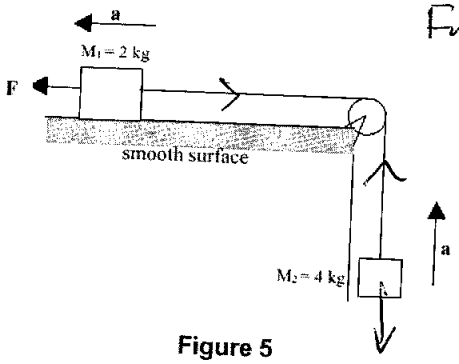


Figure 5

For M_2

$$T - M_2 g = M_2 a \Rightarrow T = M_2(g+a)$$

For M_1 $\quad T - F = -M_1 a \Rightarrow T = F - M_1 a$

$$F - M_1 a = M_2(g+a)$$

$$F = M_1 a + M_2(g+a) = 2\times 3.5 + 4(9.8+3.5)$$

$$= 7 + 53.2 = 60.2\ N$$

Q2. Q17 A 90-kg man stands in an elevator that is moving up at a constant speed of 5.0 m/s. The magnitude of the force exerted by him on the floor is: (A1) 882 N.

$$N = m(g+a) = mg \quad (a=0) = 90\times 9.8 = 882\ N$$

Q#1: Q15: Two blocks of masses M1 = 2.0 kg and M2 = 4.0 kg are in contact with each other and move on a frictionless horizontal surface under the action of a horizontal force F = 60 N (see Figure 6). Find the magnitude of the force that M1 exerts on M2 . **(A1)** 40 N.

$$a = \frac{F}{M_1+M_2} = \frac{60}{6}$$

$$= 10\ m/s$$

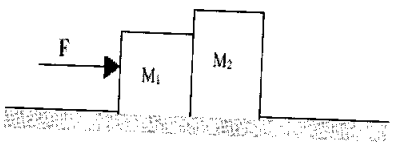
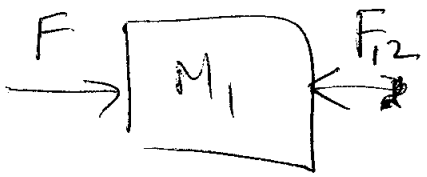


Figure 6



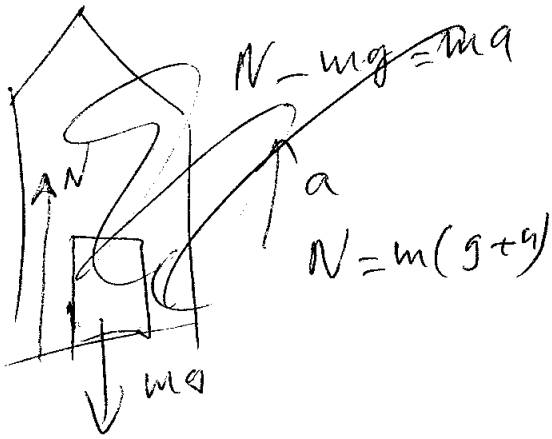
$$F - F_{12} = M_1 a$$

$$-F_{12} = M_1 a - F$$

$$= 2\times 10 - 60$$

$$+F_{12} = +40\ N$$

$$|F_{21}| = |F_{12}|$$



Quiz #4 Ch.#5 **T133** **Phys101.02-v6**

Student ID:..... **Student Name:**.....

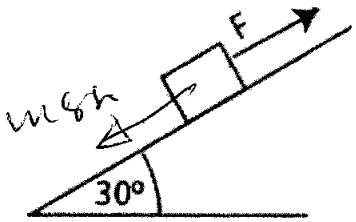
Q2.: **Q13:** A block of mass m = 4.0 kg is pushed up a smooth 30 deg inclined plane, by a constant force F of magnitude 40 N and parallel to the incline. Find the magnitude of the acceleration of the block. **(A1)** 5.1 m/s**2

$$F - mg\sin\theta = +ma$$

$$a = \frac{F - mg\sin\theta}{m}$$

$$= \frac{40 - 4\times 9.8\times \sin 30}{4}$$

$$a \doteq 5.1\ m/s^2$$



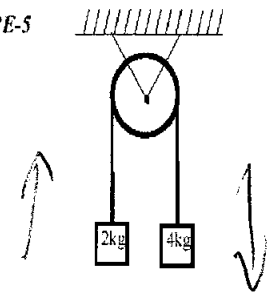
Q2. **Q17:** Two masses m1 = 2kg, m2 = 4 kg are connected by a light string Q0 that passes over a frictionless and massless pulley (see Fig. 5). Find the magnitude of the acceleration of the masses. **(A1)** 3.27 m/s**2

$$a = \left(\frac{m_2 - m_1}{m_2 + m_1}\right) g$$

$$= \left(\frac{4-2}{4+2}\right) 9.8$$

$$= \frac{2}{6} \times 9.8 = 3.27\ m/s^2$$

FIGURE-5



Q#2: . : **Q15** A 700-kg elevator accelerates downward at 3.8 m/s**2. The tension force of the cable on the elevator is: **(A1) 4.2 kN, up**

Quiz #4 Ch.#5 T133 Phys101.02-v7

Student ID:..... **Student Name:**.....

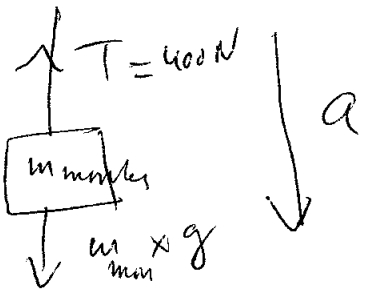
Q#1: Q21 A monkey hangs vertically from a rope in a descending elevator that decelerates at 2.4 m/s**2.If the tension in the rope is 400 N, find the mass of the monkey. (A1) 33 kg.

$T - m_{monk} \times g = m_{monk} \times a$

$T = m_{monk}(g+a)$

$m_{monk} = \frac{T}{g+a} = \frac{400}{9.8+2.4}$

$= 32.78 \text{ kg} \simeq 33 \text{ kg}$



Q2. Q16Two blocks, of equal mass = M, rest on frictionless surfaces, as shown in Fig 3. Assuming the pulleys to be light and frictionless, calculate the time required for block A to move 0.5 m down the plane, starting from rest. (Ans: 0.64 s)

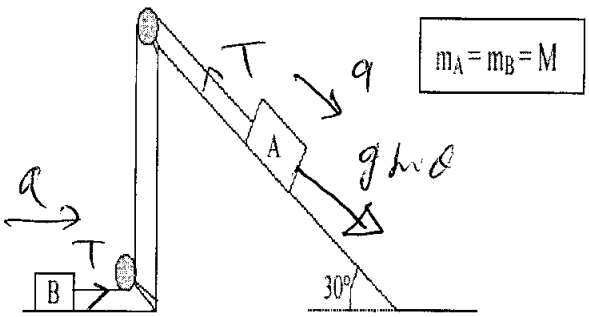


Figure 3

$T = m_B a$

$T - m_A g \sin\theta = -m_A a$

$T = m_A(g \sin\theta - a)$

Then

$m_B a = m_A(g \sin\theta - a)$

$(m_B + m_A) a = m_A g \sin\theta$

$a = \frac{m_A g \sin\theta}{m_B + m_A}$

$a = \frac{M g \sin\theta}{M+M} = \frac{M g \sin\theta}{2M} = \frac{g \sin\theta}{2} = 2.45 \text{ m/s}$

$X = \frac{1}{2} a t^2$

$t = \sqrt{\frac{2X}{a}} = \sqrt{\frac{2 \times 0.5}{2.45}} = 0.64 \text{ sec}$

Quiz #4 Ch.#5 T133 Phys101.02-v8

Student ID:..... **Student Name:**.....

Q1) Q16. A 5.0-kg block and a 10-kg block are connected by a light string as shown in Figure 3. If the pulley is massless and the surface is frictionless, the magnitude of the acceleration of the 5.0 kg block is (Ans: 6.5 m/s^2

$T = 5a$

$T - 10 \times g = -10 \times a$

$T = 10 \times 9.8 - 10a$

$= 5a$

$15a = 10 \times 9.8$

$a = \frac{10 \times 9.8}{15} = 6.53 \ m/s^2$

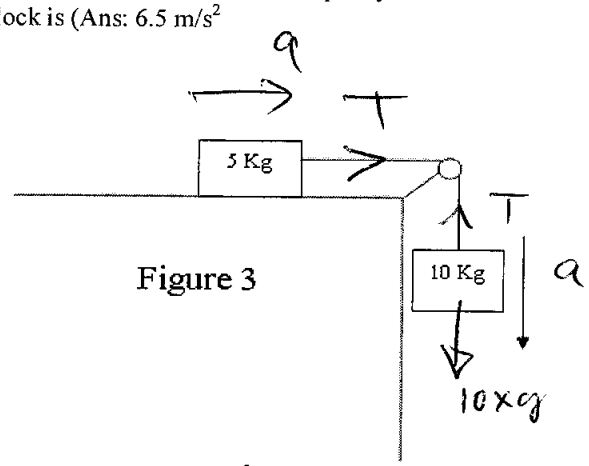


Figure 3

Q2: Two blocks of masses M1 = 2.0 kg and M2 = 4.0 kg are in contact with each other and move on a frictionless horizontal surface under the action of a horizontal force F = 60 N (see Figure 6). Find the magnitude of the force that M1 exerts on M2 . **(A1)** 40 N.

$a = \frac{60}{M_1 + M_2} = \frac{60}{6} = 10 \ m/s$

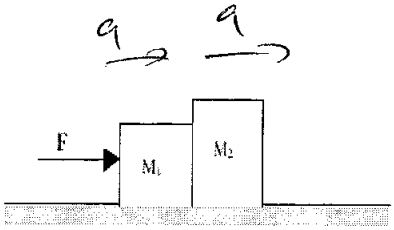
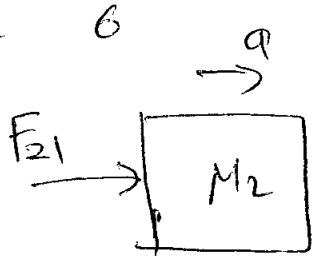


Figure 6



$F_{21} = M_2 a$

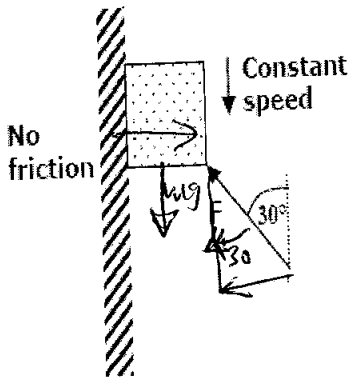
$= 4 \times 10 = 40N$

$|F_{12}| = |F_{21}| = 40 \ N$

Quiz #4 Ch.#5 T133 Phys101.02-v9

Student ID:..... Student Name:.....

Q1 Q14: A 2.0 kg box slides down a frictionless vertical wall while you push on it with a force F at a 30 degrees angle with the vertical (see Fig 3). What is the magnitude of the normal force of the wall on the box if it is to slide down at a constant speed? **(A1)** 11.3 N



$-F\sin\theta + N = 0$

$N = F\sin\theta$

but $F\cos\theta = mg \Rightarrow F = \frac{mg}{\cos\theta}$

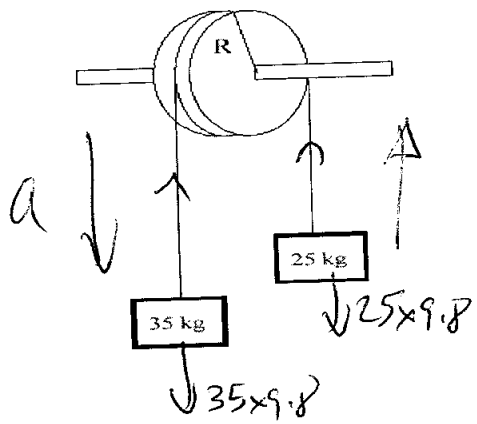
$N = F\sin\theta = \frac{mg}{\cos\theta}\cdot\sin\theta$

$= mg\tan\theta = 2\times 9.8\times\tan 30$

$N = 11.32\ N$

. **Q2**Q16 Two blocks weighing 25 kg and 35 kg respectively, are connected by a string that passes over a mass less pulley as shown in Fig. 5. The tension in the string is: (A1) 286 N .

FIGURE 5



$a = \left(\frac{35-25}{35+25}\right)\times 9.8$

$= 16.33\ m/s$

$T - 25\times 9.8 = 25\times a.$

$T = 25\times 9.8 + 25\times 16.33$

$= 285.8 = 286\ N$

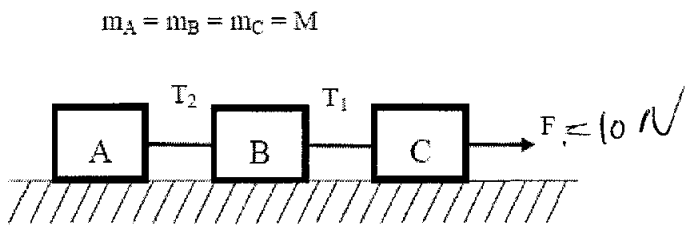
Quiz #4 Ch.#5 T133 Phys101.02-v10

Student ID:..... **Student Name:**.....

Q1: Q17 Three blocks (A,B,C), each having mass M, are connected by strings as shown in Fig.4. Block C is pulled to the right by a force F =10 N that causes the entire system to accelerate. Neglecting friction, the tension T1 between blocks B and C is: (A1) 6.67 N .

$a = \frac{F}{M+M+M} = \frac{10}{3M}$

FIGURE-4



$F - T_1 = Ma$

$-T_1 = Ma - F = \frac{10}{3M} \times M - 10 = \frac{10}{3} - 10 = -6.67$

$T = 6.67\ N$

Q14 :In the system shown in Figure 5, a horizontal force (F) acts on M1(=2.0 kg). If the acceleration of the system has a value of a = 3.5 m/s**2, find the value of (F). (Ignore force of friction). **(A1)** 60.2 N.

$T - 4 \times 9.8 = 4 \times a$

$T = 4a + 39.2$

$T - F = -2a$

$T = F - 2a = 4a + 39.2$

$F = 6a + 39.2 = 6 \times 3.5 + 39.2$

$= 60.2\ N$ ✓

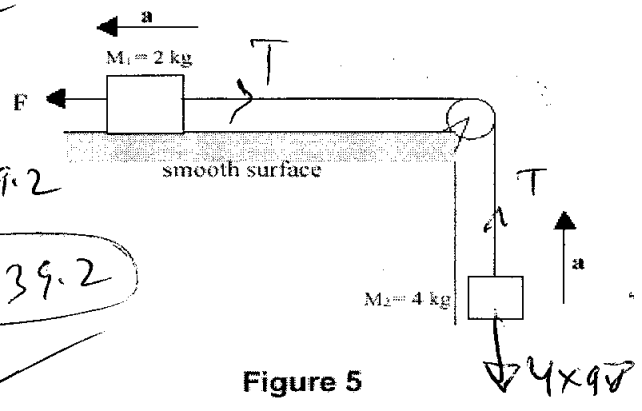


Figure 5