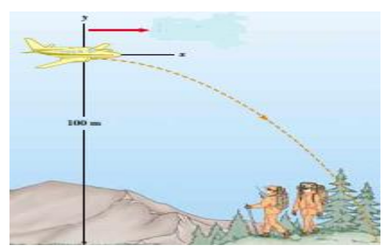
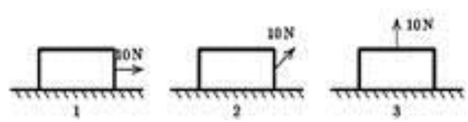
Take g = 9.8 ms^{-2} where ever needed

1	A car goes on a certain road with an average speed of 30 km/h and returns along the same road with an average speed of 50 km/h. The average speed for the round trip is: **A)** 53.2 km/h **B)** 37.5 km/h **C)** 42.7 km/h **D)** 32.1 km/h **E)** 24.5 km/h	B
2	A rock is thrown downward from an unknown height above the ground with an initial speed of 10 m/s. It strikes the ground 3 s later. Determine the initial height of the rock above the ground. **A)** 57 m **B)** 53 m **C)** 49 m **D)** 74 m **E)** 41 m	D
3	A car traveling at a constant speed of 45 m/s passes a trooper hidden behind a billboard. One second after the speeding car passes the billboard, the trooper sets out from the billboard to catch it, accelerating at a constant rate of 3 m/s^2. How long does it take him to overtake the car? **A)** 21 s **B)** 45 s **C)** 31 s **D)** 17 s **E)** 36 s	C
4	Vector **A** has *x* and *y* components of –8.7 cm and 15 cm, respectively; vector **B** has *x* and *y* components of 13.2 cm and –6.6 cm, respectively. If **A** – **B** + 3**C** = 0, the components of vector **C** are: **A)** 3.2 **i**, 1.1 **j** **B)** -3.6 **i**, 5.1 **j** **C)** -6.7 **i**, 4.1 **j** **D)** 3.2 **i**, -4.1 **j** **E)** 7.3 **i**, -7.2 **j**	E
5	A particle undergoes the following consecutive displacements: 3.5 m south, 8.2 m northeast, and 15 m west. The resultant displacement and its direction are: **A)** 10.51 m, 133° **B)** 9.48 m, 166° **C)** 8.38 m, 122° **D)** 5.32 m, 66° **E)** 12.33 m, 75°	B
6	At *t* = 0, a particle leaves the origin with a velocity of 9 **j** m/s and moves in the *xy* plane with a constant acceleration of (2**i** – 4**j**) m/s^2. At the instant the *x* coordinate of the particle is 15 m, what is the speed of the particle? **A)** 10 m/s **B)** 16 m/s **C)** 12 m/s **D)** 14 m/s **E)** 24 m/s	A
7	A plane is traveling horizontally at 30 m/s and 100 m above the ground. If the plane drops a package, where does the package strike the ground relative to the point at which it is released?  **A)** 196.5 m **B)** 135.5 m **C)** 180.8 m **D)** 311.2 m **E)** 123.4 m	B
8	Rank (رتب) the magnitude of the frictional force of the surface (from largest to smallest) in the following 3 situations, masses of all blocks are the same.  **A)** 3,2,1 **B)** All 3 are equal to each other **C)** 2,3,1 **D)** 1,3,2 **E)** 1,2,3	E

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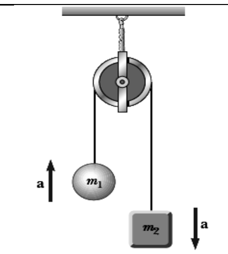
9 In the Atwood machine shown in the figure m_1=2 kg and m_2= 4 kg. If we ignore friction and the mass of the pulley and string, the tension in the string is:



A) 45.13 N **B)** 20.54 N **C)** 39.22 N **D)** 26.13 N **E)** 29.46 N

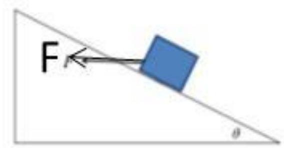
D

10 You are standing on a scale in an elevator that is accelerating downward at a constant rate of 1m/s^2. Your mass is 100kg. You look at the scale to determine your weight, it reads:

A) 680 N **B)** 880 N **C)** 980 N **D)** 1080 N **E)** 780 N

B

11 An object of mass $m = \sqrt{3}$ kg moves along a frictionless inclined plane (θ=30°) under the influence of a force $F = 10$ N as shown in figure. The acceleration of the mass is:



A) 0.1 m/s^2 **B)** 0.5 m/s^2 **C)** 1 m/s^2 **D)** 1.3 m/s^2 **E)** 2.2 m/s^2

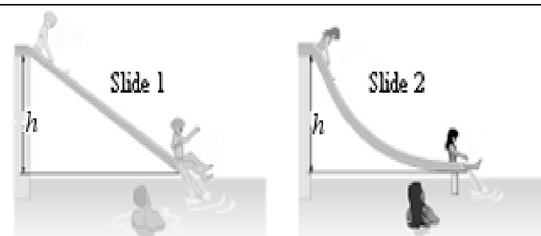
A

12 A 30 kg child rides on a circus Ferris wheel that takes her around a vertical circular path with a radius of 20 m every 22 s. What is the magnitude of the resultant force on the child at the highest point on this trajectory?

A) 49 N **B)** 25 N **C)** 39N **D)** 26 N **E)** 29 N

A

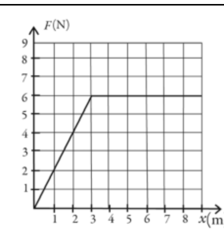
13 Swimmers slide on two frictionless water slides as shown in the figure. Both of them drop over the same height, h, **slide 1** is straight while **slide 2** is curved. What is the relation between the final velocities v_1 and v_2?



A) $v_1 = v_2$ **B)** $v_1 > v_2$ **C)** $v_1 < v_2$ **D)** $v_1 = 2v_2$ **E)** $v_2 = 2v_1$

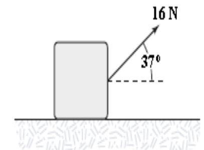
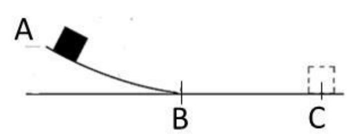
A

14 A graph of the force on an object is shown in figure. Determine the amount of work done by this force on the object that moves from x= 0 m to x= 6 m.



A) 31 J **B)** 19 J **C)** 22 J **D)** 35 J **E)** 27 J

E

15	A 3 kg block is dragged over a rough horizontal surface by a constant force of 16 N acting at an angle of 37° above the horizontal as shown. The speed of the block increases from 4 m/s to 6 m/s in a displacement of 5 m. The work done by the friction force during this displacement is:  **A)** 30 J **B)** -64 J **C)** -94 J **D)** -34 J **E)** 64 J	D
16	A child pulls a cart with a horizontal force of 77 N. If the cart moves horizontally a total distance 42 m in 3 min, what is the average power generated by the child? **A)** 22 W **B)** 15 W **C)** 27 W **D)** 18 W **E)** 29 W	D
17	A 75 kg man climbs the stairs to the fifth floor of a building of height 16 m. His potential energy has increased by: **A)** 11.76 kJ **B)** 15.23 kJ **C)** 27.17 kJ **D)** 18.04 kJ **E)** 24.07 kJ	A
18	A boy on a bicycle traveling at 10 m/s on a horizontal road stops pedaling as he starts up a hill inclined at 3° to the horizontal. If friction forces are ignored, how far up the hill does he travel before stopping? **A)** 97.4 m **B)** 81.7 m **C)** 27.3 m **D)** 32.3 m **E)** 63.4 m	A
19	What does the slope of a graph of U(*x*) versus x represent? **A)** the magnitude of the force on the object. **B)** the negative of the magnitude of the force on the object. **C)** the *x* component of the force on the object. **D)** the negative of the *x* component of the force on the object. E) None of these is correct.	D
20	A block starts from rest at the top of a frictionless incline of height 20 m and angle 20° is sliding on a frictionless surface. At the bottom of the incline, The block encounters a horizontal surface where the coefficient of kinetic friction between the block and the ground is 0.21. How far does the block travel on the horizontal surface before coming to rest?  **A)** 82.1 m **B)** 95.2 m **C)** 101.4 m **D)** 78.7 m **E)** 113.3 m	B
21	A 7 Kg object moving with velocity 3 m/s collides with and sticks to an 8 kg object initially at rest. The magnitude of the velocity of the system after the collision is: **A)** 1.9 m/s **B)** 2.4 m/s **C)** 1.4 m/s **D)** 1.7 m/s **E)** 2.3 m/s	C
22	An 8 kg object moving with velocity 4 m/s in the positive *x* direction has a one-dimensional collision with a 2 kg object moving 3 m/s in the opposite direction. The final velocity of the 8 kg object is 2 m/s in the positive *x* direction. The total kinetic energy of the two-mass system after the collision is: **A)** 35 J **B)** 25 J **C)** 29 J **D)** 16 J **E)** 41 J	E

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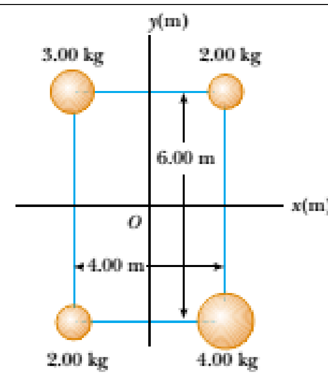
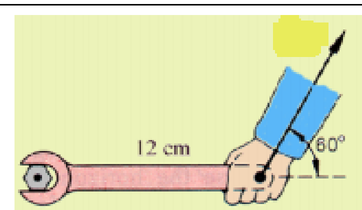
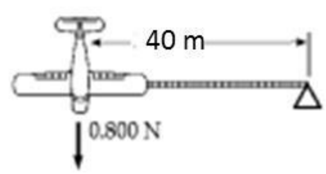
23	In a perfectly inelastic one-dimensional collision between two objects, what condition alone is necessary so that all of the original kinetic energy of the system is gone after the collision? **A)** The objects must have momenta with the same magnitude but opposite directions. **B)** The objects must have the same mass. **C)** The objects must have the same velocity. **D)** The objects must have the same speed, with velocity vectors in opposite directions. E) None of these is correct.	A
24	A rotating wheel requires 3 s to rotate through 37 revolutions. Its angular speed at the end of the 3 s interval is 95 rad/s. The angular acceleration of the wheel is: **A)** 11.67 rad/s^2 **B)** 16.21 rad/s^2 **C)** 8.11 rad/s^2 **D)** 13.36 rad/s^2 **E)** 9.48 rad/s^2	A
25	Four particles are connected by rigid rods of negligible mass. The origin is at the center of the rectangle. If the system rotates in the *xy* plane about the *z* axis with an angular speed of 6 rad/s, The rotational kinetic energy of the system is:  **A)** 3.7 kJ **B)** 1.62 kJ **C)** 1.32 kJ **D)** 2.11 kJ **E)** 2.57 kJ	E
26	An 80 N force acts at the end of a 12 cm wrench (see the figure). The torque is:  **A)** 1.36 N.m **B)** 11.24 N.m **C)** 8.31 N.m **D)** 4.23 N.m **E)** 3.41 N.m	C
27	A model airplane with mass 0.75 kg is tethered by a wire so that it flies in a circle 40 m in radius. The airplane engine provides a net thrust of 0.80 N perpendicular to the tethering wire. The angular acceleration of the airplane when it is in level flight is:  **A)** 0.12 rad/s^2 **B)** 0.81 rad/s^2 **C)** 0.037 rad/s^2 **D)** 0.18 rad/s^2 **E)** 0.027 rad/s^2	E

The End