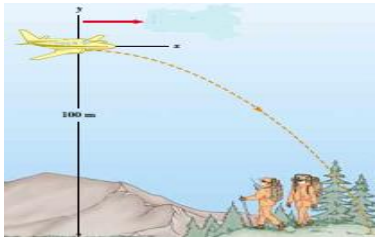
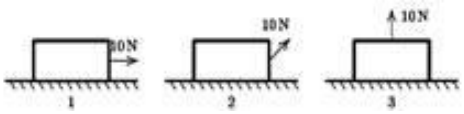
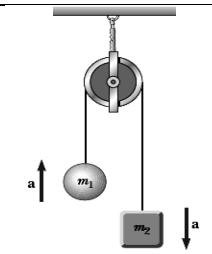
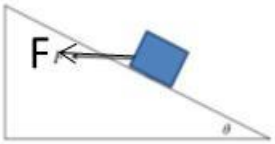
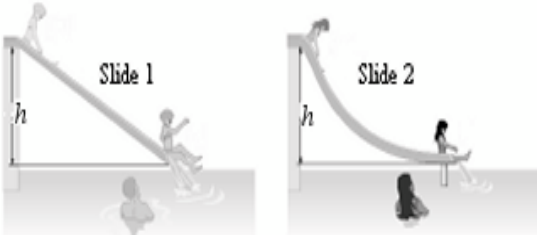
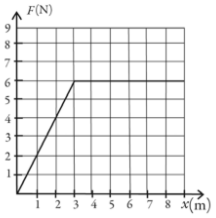
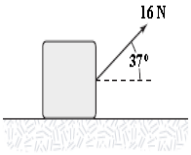
University * _____name_____

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	
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	
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	
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**	
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°	
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	
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	
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	

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	
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	
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	
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	
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)** $v_2 = 2v_1$	
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	

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

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

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

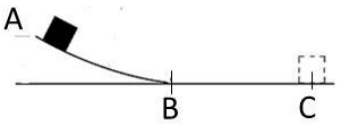
18 A boy on a bicycle traveling at 10 m/s on a horizontal road stops pedaling as he starts up a hill inclined at 3º to the horizontal. If friction forces are ignored, how far up the hill does he travel before stopping?

A) 97.4 m **B)** 81.7 m **C)** 27.3 m **D)** 32.3 m **E)** 63.4 m

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.

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

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

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

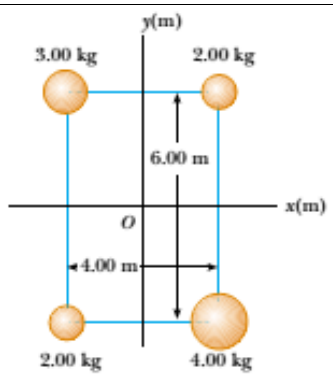
23 In a perfectly inelastic one-dimensional collision between two objects, what condition alone is necessary so that all of the original kinetic energy of the system is gone after the collision?

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.

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:

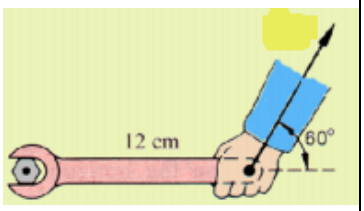
A) 11.67 rad/s^2 **B)** 16.21 rad/s^2 **C)** 8.11 rad/s^2 **D)** 13.36 rad/s^2 **E)** 9.48 rad/s^2

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:



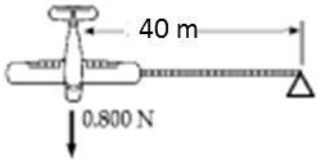
A) 3.7 kJ **B)** 1.62 kJ **C)** 1.32 kJ **D)** 2.11 kJ **E)** 2.57 kJ

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

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

The End