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Take g = 9.8 ms^{-2} wherever needed

Q	Multiple choice questions
1	If the dimensions of force (F) and energy (E) are ML/T^2, and ML^2/T^2 respectively, which of the following equations is dimensionally correct? (*m, x, a, v*, and *t* represent mass, distance, acceleration, speed, and time respectively) A) $x = \frac{1}{2}at^3$ B) $v = \sqrt{Fx/m}$ C) $E = \frac{1}{2}mv$ D) $x = \frac{1}{2}vt^2$
2	How far does a boy run in 1.5 hours if his average speed is 2.23 m/s? A) 8 km B) 3 km C) 6 km D) 12 km
3	A speed boat has a constant acceleration of 2 m/s^2. If the initial velocity of the boat is 6 m/s, its displacement after 8 s is? A) 112 m B) 124 m C) 76 m D) 83 m
4	A stone is dropped from rest from the top of a tall building. After 3 s of free fall, its displacement from top of the building is: A) + 54.2 m B) – 23.3 m C) – 44.1 m D) + 38.2 m
5	A ball is thrown upward. While the ball is in free fall, does its acceleration: A) increase B) remain constant C) decrease D) increase and then decrease
6	A displacement vector **r** has a magnitude of 175 m and points at an angle of 50° relative to the positive *x*-axis. The *x* and *y* components of this vector are respectively: A) 145 m, 117 m B) 34 m, 56 m C) 101 m, 90 m D) 112 m, 134 m
7	A boy runs 145 m in a direction 20° east of north and then 105 m in a direction 35° south of east. The magnitude of his displacement is: A) 176 m B) 95 m C) 165 m D) 155 m
8	The *x* components of a spacecraft's initial velocity and acceleration are v_{0x} = 22 m/s, and a_x = 24 m/s^2 respectively. The corresponding y components are v_{0y} = 14 m/s, and a_y = 12 m/s^2. At time t = 7 s, the magnitude of the spacecraft's final velocity is: A) 123 m/s B) 214 m/s C) 76 m/s D) 274 m/s

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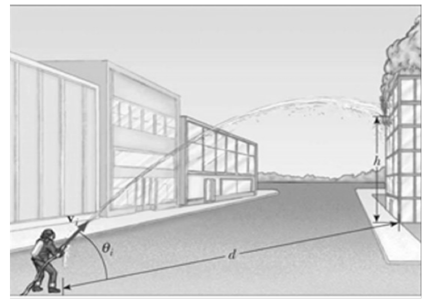
9	A football player kicks a ball at an angle θ = 40° above the horizontal axis. If the initial speed of the ball is 22 m/s, the maximum height that the ball reach is: A) 25 m B) 20 m C) 10 m D) 15 m
10	A firefighter, at a distance d = 50 m from a burning building, directs a stream of water from a fire hose at an angle θ = 30° above the horizontal (as in the Figure). If the initial speed of the water stream is 40 m/s, the height at which the water strike the building is:  A) 18.7 m B) 13.6 m C) 5.6 m D) 31.2 m
11	As a projectile thrown upward moves in its parabolic path, its velocity horizontal component A) decrease B) increase C) remain constant D) decrease and then increase
12	A 2 kg object has acceleration $a = (i - 5j)\ m/s^2$. The magnitude of the resultant force acting on it is: A) 10.2 N B) 8.5 N C) 17.4 N D) 22.2 N
13	A 5 kg block is left at rest on the top of a rough incline surface of θ =30 °. If the block slides down with an acceleration of 2 m/s^2, the frictional force acting on the block is: A) 14.5 N B) 5.4 N C) 9.4 N D) 17.6 N
14	A car is traveling at 100 km/h on a horizontal road. If the coefficient of friction between the road and tires is 0.5, the minimum distance to stop the car is: A) 71.2 m B) 78.7 m C) 52.3 m D) 22.5 m
15	If a fly (object 1) collides with the windshield of a fast moving bus (object 2), which object experiences an impact force with a larger magnitude: A) the fly B) the bus C) the same force is experienced by both D) both of them will not experience any impact force

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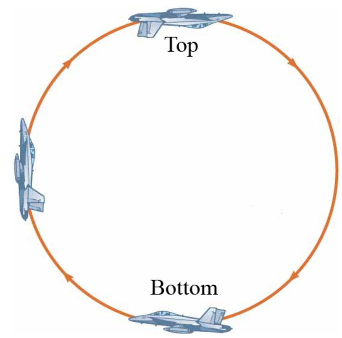
16 The pilot of an airplane executes a constant-speed loop-the-loop maneuver in a vertical circle (as in the figure). The speed of the airplane is 225 m/s, and the radius of the circle is 2.7 km. If the pilot's true weight is 700 N, his apparent weight at the lowest point is:



A) 5 kN B) 4 kN C) 3 kN D) 2 kN

17 If a person lifts a 20 kg bucket from a well and does a 6 kJ of work, the depth of the well is: (assume the speed of the bucket is constant)

A) 30.6 m B) 22.3 m C) 15.5 m D) 7.8 m

18 If you push a 40 kg box at a constant speed of 1.4 m/s across a horizontal floor of $\mu_k = 0.25$, the rate of energy dissipation by the frictional force is:

A) 34 W B) 98 W C) 137 W D) 173 W

19 One bullet has twice the mass of a second bullet. If both are fired so that they have the same speed, which of the following statements is true?

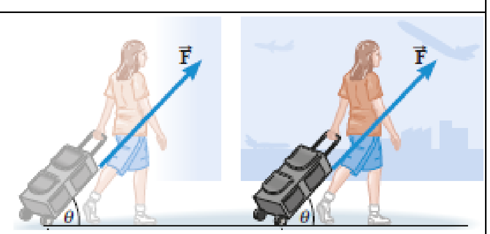
A) The 1st bullet has twice the kinetic energy than that of the 2nd one

B) The 2nd bullet has twice the kinetic energy than that of the 1st one

C) The 1st bullet has 0.5 times the kinetic energy than that of the 2nd one

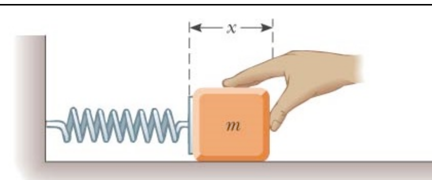
D) The 2nd bullet has 0.25 times the kinetic energy than that of the 1st one

20 In the figure, the work done by a force F = 45 N to pull the suitcase at an angle θ = 50° for a distance s = 75 m is:



A) 2.17 kJ B) 3.52 kJ C) 4.11 kJ D) 1.71 kJ

21 A block of mass 2 kg is kept at rest as it compresses a horizontal spring (k=100 N/m) a distance x =10 cm. As the block is released, it travels 0.25 m on a rough horizontal surface before stopping. The coefficient of kinetic friction between surface and block is:



A) 0.2 B) 0.4 C) 0.1 D) 0.3

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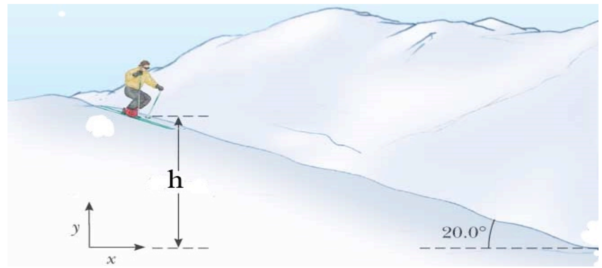
22 A skier starts from rest at the top of a frictionless incline ($\theta = 20°$) of height h = 30 m (as in the figure). The speed of the skier at the bottom of the incline is:

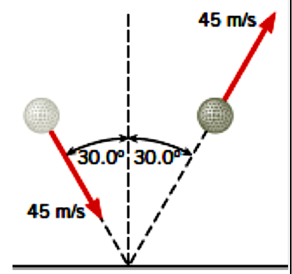


A) 17.1 m/s B) 24.2 m/s C) 7.6 m/s D) 32.3 m/s

23 If we know the potential energy function *U(x)* for a conservative system in which a one-dimensional force *F(x)* acts on a particle, we can find the force as:

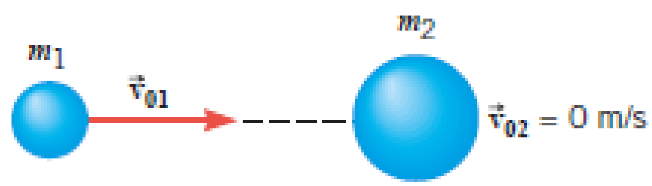
A) $F(x) = -\frac{du(x)}{dx} + u(x)$ B) $F(x) = \frac{du(x)}{dx}$ C) $F(x) = -du(x)$ D) $F(x) = -\frac{du(x)}{dx}$

24 A golf ball strikes a hard, smooth floor at an angle of 30° and rebounds at the same angle (as in the figure). The mass of the ball is 0.047 kg, and its speed is 45 m/s just before and after striking the floor. The magnitude of the impulse applied to the golf ball by the floor is:



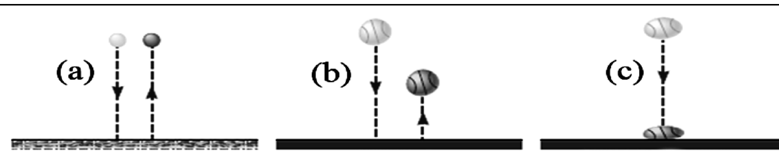
A) 2.8 N.s B) 3.7 N.s C) 2.8 N.s D) 5.6 N.s

25 A ball of mass $m_1 = 5$ kg, moving to the right at a velocity of 2 m/s on a frictionless table, collides head-on with a stationary ball of mass $m_2 = 7.5$kg. If the collision is perfect inelastic, the final velocity of the two balls after collision is:



A) 0.4 m/s B) 1.6 m/s C) 2.3 m/s D) 0.8 m/s

26 The figures show dropping different balls onto different surfaces. In figure (a), a hard steel ball will completely rebound to its original height after striking a hard surface. In figure(b), a basketball will partially rebound after striking a soft surface. In Figure (c), a basketball will not rebound at all. In which of these figures the collision is elastic:



A) Figures (b & c) B) Figure (a) C) Figure (c) D) Figure (b)

27 If a particle of mass m moves with momentum P, the kinetic energy of the particle (K) is:

A) $m^2/2p$ B) P^2/m C) $P/2m$ D) $P^2/2m$

The End