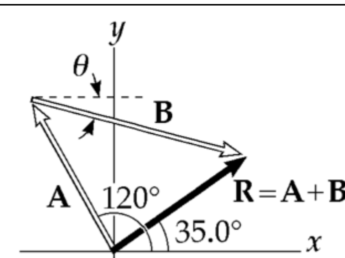
Name: ______________________________ ID:________________________

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

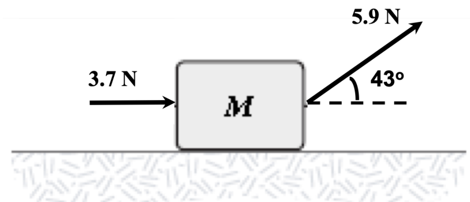
| Q | Multiple choice questions |
|---|---|
| **1** | From Hook's law, $F=-kx$, where $F$ is the force with dimension of ($MLT^{-2}$), and $x$ is spring extended length. The dimension of the spring constant $k$ is:<br>A) $ML^{-2}T^{-2}$ B) $MT^{2}$ C) $MT^{-2}$ D) $ML^{-2}T^{2}$ |
| **2** | A truck covers **40 m** in **8.50 s** while smoothly slowing down to a final speed of **2.80 m/s**. The initial speed for the truck is:<br>A) 1.2 m/s B) 6.6 m/s C) 5.3 m/s D) 9.5 m/s |
| **3** | The height of a helicopter above the ground is given by $y = 3t^3$, where $y$ is in meters and $t$ is in seconds. After hovering up for **2 s**, the helicopter releases a small box. How long after its release does the box reach the ground?<br>A) 3.55 s B) 7.96 s C) 16.88 s D) 9.35 s |
| **4** | A man pushing a box across a floor causes it to undergo two displacements. The first (**A**) has a magnitude of **150 cm** and makes an angle of **120°** with the positive ***x* axis**. The resultant displacement (**R**) has a magnitude of **140 cm** and is directed at an angle of **35.0°** to the positive ***x* axis**. The magnitude of the second displacement (**B**) is:<br><br><br>A) 196 cm B) 187 cm C) 155 cm D) 220 cm |
| **5** | 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 + 3C = 0**, the components of vector **C** are:<br>A) 3.2 **i**, -4.1 **j** B) 7.3 **i**, -7.2 **j** C) -6.7 **i**, 4.1 **j** D) -3.6 **i**, 5.1 **j** |
| **6** | A ball is thrown from a window of a building. The ball is given an initial velocity of **8 m/s** at an angle of **20°** below the horizontal. It strikes the ground **3 s** later. How far horizontally from the base of the building does the ball strike the ground?<br>A) 22.6 m B) 30.4m C) 43.3m D) 35.8 m |
| **7** | A particle moves at a constant speed in a circular path with a radius of **2 cm**. If the particle makes **four revolutions each second**, the magnitude of its acceleration is:<br>A) 14.1 $m/s^2$ B) 5.5 $m/s^2$ C) 12.6 $m/s^2$ D) 15.9 $m/s^2$ |
| **8** | In projectile motion, which of the following quantities stay constant during the event:<br>A) Gravitational acceleration and projectile's horizontal velocity B) Projectile's horizontal velocity only C) Gravitational acceleration only D) Gravitational acceleration and projectile's vertical velocity |

Name: ______________________________ ID: __________________________

**9** A force is applied on a **first object** its mass is **M** and produces an acceleration **a**. The same force is applied on a **second object** its mass is **3M**. What is the acceleration of the **second object**?

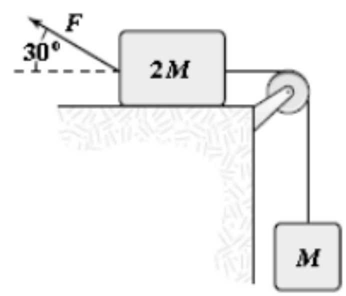
A) $\frac{1}{3}$ **a** B) 3 **a** C) **a** D) 4 **a**

**10** **Two forces** act on a **M = 4 kg** block resting on a frictionless surface as shown the Figure. What is the magnitude of the horizontal acceleration of the block?



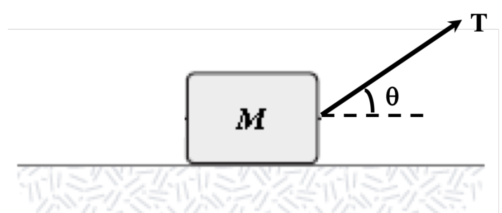

A) 8.0 m/s$^2$ B) 4.0 m/s$^2$ C) 2.0 m/s$^2$ D) 9.8 m/s$^2$

**11** If **F = 40 N** and **M = 2 kg**, what is the magnitude of the acceleration of the suspended object? All surfaces are frictionless.




A) 0.2 m/s$^2$ B) 5.0 m/s$^2$ C) 1.5 m/s$^2$ D) 2.5 m/s$^2$

**12** A block of mass **M** is pulled at constant velocity along a rough horizontal floor by an applied force **T** as shown in the Figure. The magnitude of the frictional force is:

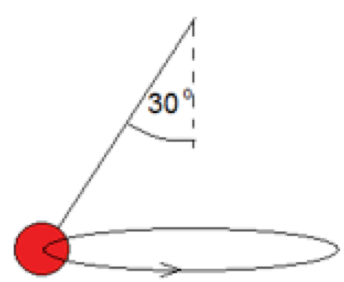



A) T cosθ B) Mg - T sinθ C) Mg D) Mg cosθ

**13** A body of mass **10 kg** moves with a velocity of **5 m/s** in a circle of radius **5 m**, what is the centripetal force of the body?

A) 5 N B) 25 N C) 0.5 N D) 50 N

**14** A **2 kg** ball attached to a string is made to move in a circular as shown in the Figure, if the tension in string is **23.1 N** the centripetal force is:




A) 11.6 N B) 5.8 N C) 23.1 N D) 20 N

Name: ______________________________ ID: ________________________

**15** The force of an ideal spring exerts on an object is given by $\boldsymbol{F_x = -kx}$, where $\boldsymbol{x}$ measures the displacement of the object from its equilibrium ($\boldsymbol{x = 0}$) position. If $\boldsymbol{k}$ **= 60 N/m**, how much work is done by this force as the object moves from $\boldsymbol{x = -0.20}$ m to $\boldsymbol{x = 0}$?

A) -2.4 J B) -1.2 J C) +2.4 J D) +1.2 J

**16** Equal amounts of work are performed on two bodies, **A** and **B**, initially at rest, and of masses $\boldsymbol{M}$ and **2**$\boldsymbol{M}$ respectively. The relation between their speeds immediately after the work has been done on them is:

A) $v_A = 2v_B$. B) $v_A = \sqrt{2}\, v_B$ C) $v_A = v_B$ D) $v_B = \sqrt{2}\, v_A$

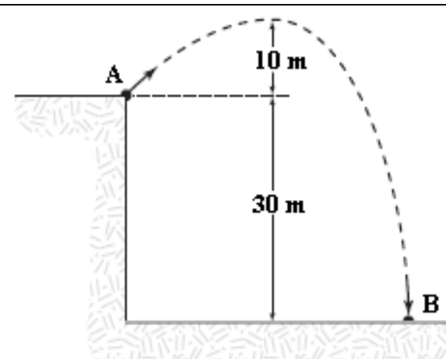
**17** A box weighing **6000 N** is pulled across a flat surface by means of a horizontal rope. The coefficient of kinetic friction is **0.05**. The work done by the man in pulling the box **1000 m** at constant velocity is:

A) $3.1 \times 10^4$ J B) $1.5 \times 10^5$ J C) $2.9 \times 10^6$ J D) $3.0 \times 10^5$ J

**18** A person vertically holds an **80 N** weight **2 m** above the floor for **30 seconds**. The power required to do this is:

A) 80 W B) 0 W C) 40 W D) 20 W

**19** A **0.04 kg** ball is thrown from the top of a **30 m** tall building (point **A**) at an unknown angle above the horizontal. As shown in the Figure, the ball reaches a maximum height of **10 m** above the top of the building before striking the ground at point **B**. If air resistance is negligible, what is the value of the kinetic energy of the ball at **B** minus the kinetic energy of the ball at **A** (i.e. $K_B - K_A$)?




A) -15.7 J B) +15.7 J C) +11.7 J D) -11.7 J

**20** A stone is pushed vertically against a spring a distance $\boldsymbol{d}$. When released, its maximum height above the ground is $\boldsymbol{h_1}$. If the same stone is pushed against the same spring a distance **2**$\boldsymbol{d}$, then its maximum height $\boldsymbol{h_2}$ above the ground is:

A) $h_2 = 4h_1$ B) $h_2 = h_1$ C) $h_2 = 2h_1$ D) $h_2 = 8h_1$

**21** A block with initial velocity $\mathbf{v_i}$ slides across a rough horizontal tabletop through a distance $\boldsymbol{d}$. One of the following is correct:

A) $\Delta E_{mech} = 0$ B) $\Delta K = 0$ C) $\Delta K = -f_k d$ D) $\Delta E_{mech} = f_k d$

Name: _______________________________ ID:________________________

**22** A **40 kg** boy slides down a ramp. The ramp is **8 m** in length and inclined at an angle of **30°**. The boy starts from rest at the top, experiences a constant friction force of magnitude **115 N**. How fast is he traveling when he reaches the bottom?

A) 8.85 m/s B) 5.69 m/s C) 12.5 m/s D) 6.78 m/s

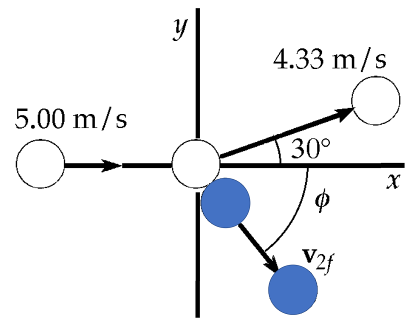
**23** The potential energy of an object constrained to the $x$ axis is given by $U(x) = 8x^2 - x^3$. The force $F$ associated with this potential energy function is:

A) $8x^2 - x^3$ B) $16x - 3x^2$ C) $-16x + 3x^2$ D) $16x + 3x^2$

**24** A **2.4 kg** ball falling vertically hits the floor with a velocity of **-2.5j m/s** and rebounds with a velocity of **1.5j m/s**. What is the magnitude of the impulse exerted on the ball by the floor?

A) 9.6 N·s B) 2.4 N·s C) 6.4 N·s D) 1.6 N·s

**25** A billiard struck ball (الكرة الضاربة) moving at **5 m/s** strikes a stationary ball (كرة ساكنه) of the same mass. After the collision, the first ball moves, at **4.33 m/s**, at an angle of **30°** with respect to the original line of motion, as shown in the Figure. Assuming an elastic collision (and ignoring friction and rotational motion). Then, the struck ball's velocity ($\mathbf{v}_{2f}$) after the collision is:




A) 20.1 m/s B) 9.4 m/s C) 4.5 m/s D) 2.5 m/s

**26** A **6 kg** object moving **5 m/s** collides with and sticks to an **2 kg** object. After the collision the composite object is moving **2 m/s** in a direction opposite to the initial direction of motion of the **6 kg** object. Determine the speed of the **2 kg** object before the collision.

A) 15 m/s B) 7 m/s C) 11 m/s D) 23 m/s

**27** Two objects are at rest on a frictionless surface. **Object 1** has a greater mass than **object 2**. When a force is applied to **object 1**, it accelerates for a time interval (**t**). The force is removed from **object 1** and is applied to **object 2**. After **object 2** has accelerated for the same time interval (**t**), which statements are true? (P: momentum, K: kinetic energy )

A) $P_1 < P_2$ B) $P_1 > P_2$ C) $K_1 < K_2$ D) $K_1 = K_2$

**The End**