Part 1: *(1 point each)*

For the following questions, please circle ◯ the correct answer to the nearest number.

1. The mathematical relationship between three physical quantities is given by $a = \frac{b^2}{c}$. If the dimension of ***b*** is; $\frac{[L]}{[T]}$ and the dimension of ***c*** is [L]. Which one of the following choices is the dimension of ***a***?

A) [L] B) $\frac{[L]}{[T]}$ C) $\frac{[L]^2}{[T]^2}$ D) $\frac{[L]}{[T]^2}$ E) [T]

2. A motorist driving a **1050 kg** car wishes to increase her speed from **20 m/s** to **30 m/s** in **5 s**. Determine the horsepower required to accomplish this increase. Neglect friction.

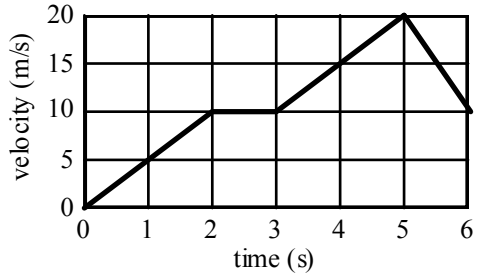
A) 70 hp B) 20 hp C) 30 hp D) 80 hp E) 90 hp

3. A car starts from rest and accelerates at a constant rate in a straight line. In the ***first*** second the car covers a distance of **2.0 meters**. How much *additional* distance will the car cover during the ***second*** second of its motion?

A) 2.0 m B) 4.0 m C) 6.0 m D) 8.0 m E) 13 m

4. An object is moving along a straight line. The graph shows the object's velocity as a function of time.

During which interval(s) of the graph does the object travel *equal distances* in *equal times*?



A) 0 s to 2 s
B) 2 s to 3 s
C) 0 s to 2 s and 3 s to 5 s
D) 3 s to 5 s
E) 0 s to 2 s, 3 to 5 s, and 5 to 6 s

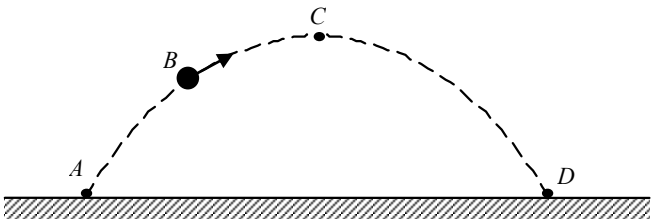
5. A projectile is launched with **200 kg · m/s** of momentum and **1000 J** of kinetic energy. What is the mass of the projectile?

A) 5 kg B) 10 kg C) 40 kg D) 20 kg E) 50 kg

6 A ball is hit upward and travels along a parabolic arc before it strikes the ground. Which one of the following statements is necessarily true?

A) The acceleration of the ball decreases as the ball moves upward.
B) The velocity of the ball is zero m/s when the ball is at the highest point in the arc.
C) The acceleration of the ball is zero m/s^2 when the ball is at the highest point in the arc.
D) The *x*-component of the velocity of the ball is the same throughout the ball's flight.
E) The velocity of the ball is a maximum when the ball is at the highest point in the arc.

7. A tennis ball is thrown upward at an angle from **point *A***. It follows a parabolic trajectory and hits the ground at **point *D***. At the instant shown, the ball is at **point *B***. **Point *C*** represents the highest position of the ball above the ground. *Ignore air resistance.*



While in flight, how do the ***x*** and ***y*** components of the velocity vector of the ball compare at the points ***B*** and ***C***?

A) The velocity components are non-zero at *B* and zero at *C*.
B) The *x* components are the same; the *y* component at *C* is zero m/s.
C) The *x* components are the same; the *y* component has a larger magnitude at *C* than at *B.*
D) The x component is larger at C than at B; the y component at B points up while at C, it points downward.
E) The *x* component is larger at *B* than at *C*; the *y* component at *B* points down while at *C*, it points upward.

8. Which statement is true concerning the ball in the figure above when it is at ***C***, the highest point in its trajectory?

A) The ball's velocity and acceleration are both zero.
B) The ball's velocity is perpendicular to its acceleration.
C) The ball's velocity is not zero, but its acceleration is zero.
D) The ball's velocity is zero, but its acceleration is not zero.
E) The horizontal and vertical components of the ball's velocity are equal.

9. A **2.00 kg** projectile is fired at an angle of **20.0°**. What is the magnitude of the force exerted on the projectile when it is at the highest position in its trajectory? Neglect any effects of air resistance.

A) 19.6 B) 14.7 N C) 9.80 N D) 4.90 N E) 0 N

10. An astronaut orbits the earth in a space capsule whose height above the earth is equal to the earth's radius. How does the mass of the astronaut in the capsule compare to her mass on the earth?

A) Her mass is equal to her mass on earth.
B) Her mass is equal to one-fourth her mass on earth.
C) Her mass is equal to one-half of her mass on earth.
D) Her mass is equal to one-third of her mass on earth.
E) Her mass is equal to one-sixteenth her mass on earth.

11. A car traveling at **20 m/s** rounds a curve so that its centripetal acceleration is **5 m/s^2**. What is the radius of the curve?

A) 4 m B) 8 m C) 80 m D) 160 m E) 640 m

12. Which one of the following statements concerning kinetic energy is true?

A) Kinetic energy can be measured in watts.
B) Kinetic energy is always equal to the potential energy.
C) Kinetic energy is always positive.
D) Kinetic energy is a quantitative measure of inertia.
E) Kinetic energy is directly proportional to velocity.

13. A skier leaves the top of a frictionless slope with an initial speed of **5.0 m/s.** Her speed at the bottom of the slope is **13 m/s**. What is the height of the slope?

A) 1.1 m B) 7.3 m C) 4.6 m D) 6.4 m E) 11 m

14. A **10.0 g** bullet traveling horizontally at **755 m/s** strikes a stationary target and stops after penetrating **14.5 cm** into the target. What is the average force of the target on the bullet?

A) 1.97×10^4 N B) 2.07×10^5 N C) 6.26×10^3 N D) 3.13×10^4 N
E) 3.93×10^4 N

15. A **2.0 kg** projectile is fired with initial velocity components $\boldsymbol{v_{ox}}$ **= 30 m/s** and $\boldsymbol{v_{oy}}$ **= 40 m/s** from a point on the earth's surface. Neglect any effects due to air resistance. How much work was done in firing the projectile?

A) 900 J B) 1600 J C) 2500 J D) 4900 J E) 9800 J

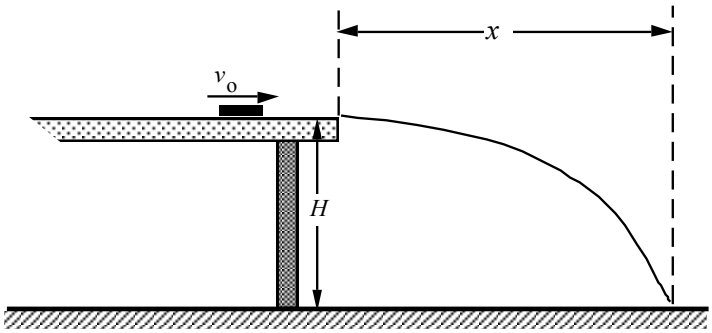
16. A football player kicks a **0.41 kg** football initially at rest; and the ball flies through the air. If the kicker's foot was in contact with the ball for **0.051 s** and the ball's initial speed after the collision is **21 m/s,** what was the magnitude of the average force on the football?

A) 9.7 N B) 46 N C) 81 N D) 169 N E) 210 N

Part 2:

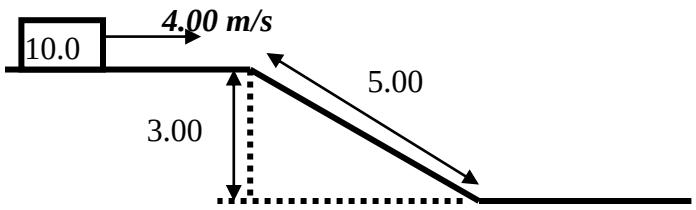
Please read each question carefully and show your steps in the space provided with the appropriate units to receive partial credit. No credit will be given for writing down formulae. Each question is graded on a 4 points scale. ***Draw a Free Body Diagram when is needed.***

1. A puck slides across a smooth, level tabletop at height ***H*** at a constant speed $\boldsymbol{v_0}$. It slides off the edge of the table and hits the floor a distance *x* away as shown in the figure. Find the distances ***x*** in terms of the initial velocity $\boldsymbol{v_O}$ and the height ***H***? **(4 points)**



***Answer*_____**

2. A **10.0-kg** crate slides along a horizontal frictionless surface at a constant speed of **4.00 m/s**. The crate then slides down a frictionless incline and across a second horizontal surface as shown in the figure. What minimum coefficient of kinetic friction is required to bring the crate to a stop over a distance of **5.0 m** along the lower surface?**?** **(4 points)**



***Answer*_____**

3. A **35 kg** girl is standing near and to the left of a **43 kg** boy on the frictionless surface of a frozen pond. The boy throws a **0.75 kg** ice ball to the girl with a horizontal speed of **6.2 m/s.** What are the velocities of the boy and the girl immediately after the girl catches the ice ball? **(4 points)**

***Answer (Boy)*_____**
***Answer (Girl))*_____**

4. A **0.25 kg** ball attached to a string is rotating in a horizontal circle of radius **0.5 m**. If the ball revolves **twice every second**, what is the tension in the string? **(3 points)**

***Answer*_____**

Good Luck