

Final exam (8 conceptual questions and 8 problems for 3 hours) on Monday May 5, 2014;

Course: PHYS1111; Instructor: Tho Nguyen

First and last name: _____

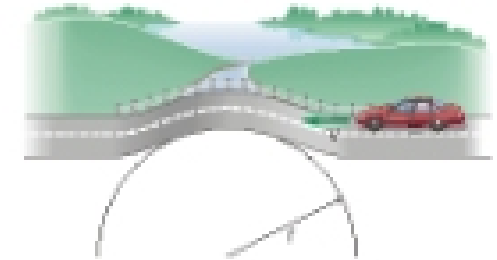
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1) A baseball is thrown vertically upwards into the air (neglect air resistance) and returns to where it started. Based on the definition of speed and velocity, justify each of these statements by stating whether they are true (T) or false (F). Put the answer in front of each statement.

- The average speed is not zero.
- The total displacement is not zero.
- The initial velocity and final velocity are equal.
- The average velocity is zero.
- The initial speed and final speed are equal.
- The average acceleration is zero.

2) You are driving your car (mass m) over a circular-shaped bump in the road that has a radius r . The normal force (apparent weight) of your car when it passes the bump is:

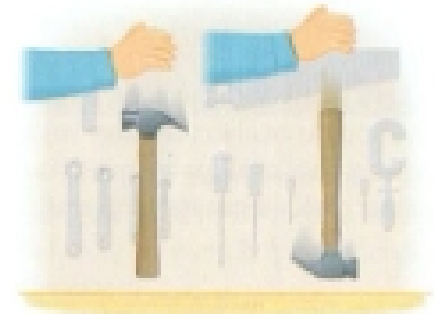
- (a) larger than the $m \cdot g$
- (b) equal to $m \cdot g$
- (c) smaller than $m \cdot g$
- (d) not be able to determine



The weight is $m \cdot g$.

3) The metal head of a hammer with a wood handle is loose. To tighten it, you drop the hammer down onto a table. Circle the correct answer:

- (i) Should you (a) drop the hammer with the handle end down, (b) drop hammer with the head end down, or (c) do you get the same result either way?
- (ii) What law did you use for your decision in (i)?
 - a) Newton's first law
 - b) Newton's second law
 - c) Newton's third law



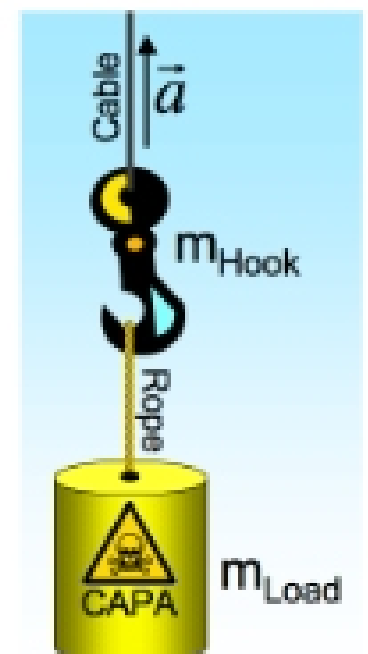
4) A barrel (mass m_{Load}) is attached to a massless rope, which is attached to a hook (mass m_{Hook}), which is attached to the massless cable of a crane (see the figure). The cable is accelerating up with an acceleration. Circle the correct answer.

i) What is the tension of the rope?

- (a) $m_{\text{Load}} \cdot g$
- (b) $m_{\text{Load}} \cdot a$
- (c) $(m_{\text{Hook}} + m_{\text{Load}}) \cdot (g - a)$
- (d) $(m_{\text{Hook}} + m_{\text{Load}}) \cdot (g + a)$
- (e) $m_{\text{Load}} \cdot (g + a)$

ii) What is the tension of the cable?

- (a) $m_{\text{Hook}} \cdot a$
- (b) $(m_{\text{Hook}} + m_{\text{Load}}) \cdot (g + a)$
- (c) $m_{\text{Hook}} \cdot (g - a)$
- (d) $(m_{\text{Hook}} + m_{\text{Load}}) \cdot (g - a)$
- (e) $m_{\text{Load}} \cdot g + m_{\text{Hook}} \cdot a$



5) A car accelerates from rest to a certain velocity in a certain time. Assume that there is no friction, and that the engine power is constant. Consider the following scenarios independently using either $P=W/t$ and work-energy theorem or $P=F \cdot v$:

(i) How long would it take to reach half the velocity (also from rest)?

- a) Half the time b) One fourth the time c) Double the time d) Four times the time.

(ii) How long would it take to reach the same velocity if the engine had twice the power?

- a) Half the time b) Same time c) Double the time d) Four times the time

(iii) If you decrease the velocity two times, the force that the engine exerts to run the car would:

- a) Increase two times b) Decrease two times c) Remain the same

6) Choose whether each of the following statements is true (T) or false (F).

.....A system of particles with zero kinetic energy must also have zero momentum.

.....An object at rest on a frictionless surface is struck by a second object. After the collision, both objects must be moving.

.....A system of particles with zero momentum must also have zero kinetic energy.

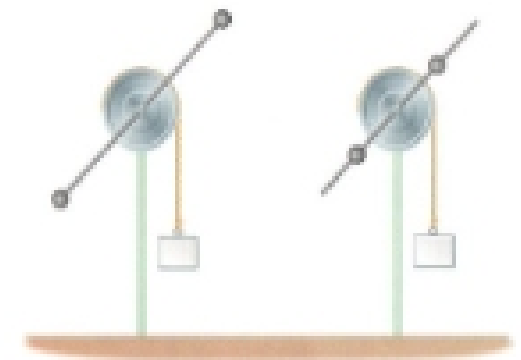
..... It is possible for two isolated objects to collide so that all the initial kinetic energy of the system is lost.

.....Two cars collide at an intersection, but do not "stick together" after the collision. Therefore, the collision was elastic.

7) The rotating systems shown below differ only in that the two spherical movable masses are positioned either far from the axis of rotation (left) or near the axis of rotation (right).

(i) Which statement is correct?

- (a) Moment of inertia of the left system is smaller.
 (b) Moment of inertia of the right system is smaller.
 (c) Moments of inertia of them are the same.



(ii) If the hanging blocks are released simultaneously from rest, which statement is correct?

- (a) The block at left lands first
 (b) The block at right lands first
 (c) Both block land at the same time.

8) A playground merry-go-round spins about its axis with negligible friction. A child moves from the center of the merry-go-round to the rim. For this system, indicate which of the following quantities changes (C) and unchanges (U).

-Mass
Moment of inertia
Angular speed
Rotational kinetic energy
Potential energy
Angular momentum



9) **(gravity)** From the Newton's law of universal gravitation, one can get the free fall acceleration closed to the surface of the planet, $g = G \frac{M}{R^2}$ where $G=6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$; M and R is the mass and radius of the planet.

- (a) What is the free fall acceleration at the surface of the Mars? Given mass of the Mars, $M=6.42 \times 10^{23} \text{ Kg}$ and its radius, $R=3.39 \times 10^6 \text{ m}$.
- (b) Compare the weight of a man with mass $m=100 \text{ kg}$ when he is on the surface of the Mars (P_M) and the Earth (P_E). Given the free fall acceleration of the Earth, $g=9.81 \text{ m/s}^2$.
- (c) Suppose two apples are dropped at the same height, a few meters from the surface of the Mars and Earth. In what case does the apple reach the surface first? Explain qualitatively your decision?