Prince Sultan University
Department of Mathematical Sciences

SCI 101 | Spring Semester 2011 | 5/11/2011
2nd Exam | H. S.

Part 1. ***(1.0 point each)***

Please circle ○ the correct answer, to the nearest number for quantitative questions, for each of the following questions:

1. Two point masses ***m*** and ***M*** are separated by a distance ***d***. If the separation ***d*** remains fixed and the masses are increased to the values **3*m*** and **3*M*** respectively, how does the gravitational force between them change?

A) The force will be one-third as great.
B) The force will be nine times as great.
C) The force will be one-ninth as great.
D) The force will be three times as great.
E) It is impossible to determine without knowing the numerical values of *m*, *M*, and *d*.

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

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

3. 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) 10 N B) 20 N C) 18.8 N D) 6.8 N E) 0.0 N

4. What is the magnitude of the gravitational force acting on a **79.5 kg** student due to a **60.0 kg** student sitting **2.25 m** away in the lecture hall?

A) 3.14×10^{-9} N B) 6.29×10^{-8} N C) 2.82×10^{-8} N
D) 1.41×10^{-7} N E) 7.91×10^{-10} N

5. A projectile fired from a gun has initial horizontal velocity component equal to **30 m/s** and vertical components of velocity equal to **40 m/s.** *Approximately* how long does it take the projectile to reach the highest point in its trajectory?

A) 2 s B) 1 s. C) 16 s. D) 8 s. E) 4 s.

6. The head of a hammer (***m* = 1.5 kg**) moving at **4.5 m/s** strikes a nail and bounces back with the same speed after an elastic collision lasting **0.075 s**. What is the magnitude of the average force the hammer exerts on the nail?

A) 6.8 N B) 60 N C) 90 N D) 240 N E) 180 N

8. A person jumps from the roof of a tall building, but no injury occurs because the person lands on a large, air-filled bag. Which one of the following best describes why no injury occurs?

A) The bag provides the necessary force to stop the person.
B) The bag increases the amount of time during which the momentum is changing and reduces the average force on the person.
C) The bag reduces the impulse to the person.
D) The bag increases the amount of time the force acts on the person and reduces the change in momentum.
E) The bag decreases the amount of time during which the momentum is changing and reduces the average force on the person.

9. Complete the following statement: Momentum will be conserved in a two-body collision *only if*

A) both bodies come to rest.
B) the collision is perfectly elastic.
C) the kinetic energy of the system is conserved.
D) the internal forces of the two body system cancel in action-reaction pairs.
E) the net external force acting on the two-body system is zero.

10. 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

11. How much power is needed to lift a **75-kg** student vertically upward at a constant speed of **0.33 m/s**?

A) 12.5 W. B) 25 W. C) 248 W. D) 115 W.
E) 230 W.

End of Part 1.

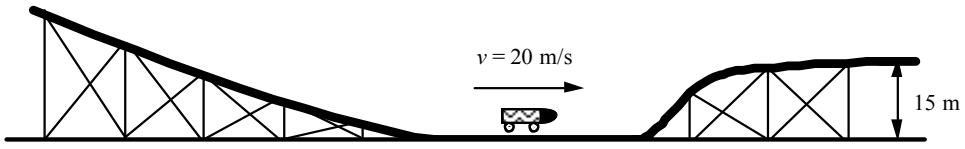
Part 2:

Please read each of the following questions carefully and show your work in the space provided. Include the appropriate units in your answer. ***(3 points each)***

P1. 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?

Answer(Boy's Velocity; Magnitude & Direction with units)_____
Answer(Girl's Velocity; Magnitude & Direction with units)_____

P2. A roller-coaster car is moving at **20 m/s** along a straight horizontal track. What will its speed be after climbing the **15 m** hill shown in the figure, if friction is ignored?



Answer (with units)_____