Prince Sultan University
SCI 101
Final Examination
Semester II, Term 092
Thursday, June 21, 2010
Time Allowed: 120 minutes

Part 1.

Please read each question carefully. Each question worth's 1 point. For the following questions, please circle ◯ the correct answer. Please round off to the nearest number for quantitative questions.

1. Suppose that an object is moving with a constant velocity. Make a statement concerning its acceleration.

(A) The acceleration must be constantly increasing.
(B) The acceleration must be constantly decreasing.
(C) The acceleration must be constant non-zero- value.
(D) The acceleration must be equal zero.
(E) A statement cannot be made without additional information.

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2. A car is making a **12-mile trip**. It travels the first **6.0 miles** at **30 miles per hour (mph)** and the last **6.0 miles at 60 miles per hour (mph)**. What is the car's average speed for the entire trip?

(A) 20 mph (B) 35 mph (C) 40 mph
(D) 45 mph (E) 50 mph

3. An object is thrown upwards with a velocity of **16 m/s**. How high does it reach after **1.0 s**?

(A) 8.0 m (B) 10 m (C) 17 m (D) 11 m
(E) not enough information to estimate the height.

4. When the distance between two objects decreases by half, and the mass of one object decreases by half, the force between them

(A) decreases by one-quarter. (B) decreases by one-half.
(C) increases to twice as much. (D) increases to four times as much
(E) stay the same.

5. A projectile is launched at an angle of **15°** above the horizontal and lands downrange. What other projection angle for the same speed would produce the same downrange distance?

(A) 30°. (B) 45°. (C) 50°. (D) 75°. (E) 90°.

6. When a parachutist jumps from an airplane, he eventually reaches a constant speed, called the terminal velocity. This means that

(A) the force of air resistance is equal to zero.
(B) the acceleration is equal to *g*.
(C) the effect of gravity has died down.
(D) the effect of gravity increases as he becomes closer to the ground.
(E) the force of air resistance is equal to the weight of the parachutist.

7. A **50.0-kg** crate is being pulled along a horizontal, smooth surface. The pulling force is **10.0 N** and is directed **20.0°** above the horizontal. What is the acceleration of the crate?

(A) 0.0684 m/s^2. (B) 0.188 m/s^2. (C) 0.200 m/s^2.
(D) 0.376 m/s^2 (E) 0.0728 m/s^2

8. A **500 kg** cannon fires a **4.0 kg** projectile with a velocity of **500 m/s** relative to the ground. What is the recoil (rebound) velocity of the cannon?

(A) 1.0 m/s (B) 2.0 m/s (C) 4.0 m/s (D) 6.0 m/s (E) 8.0 m/s

9. It takes **40 J** to push a large box **4 m** across a floor. Assuming the push is in the same direction as the move, what is the magnitude of the force on the box?

(A) 4 N. (B) 10 N. (C) 40 N. (D) 160 N. (E) none of the above.

10. A cup of water is filled to the brim (top) when an ice cube is placed in it. The tip of the ice cube sticks out of the water surface. As the ice melts, you observe that

(A) the cup overflows. (B) the water level actually goes down.
(C) the cup might overflow but it depends on the actual mass of the ice cube.
(D) the water level remains the same.
(E) There is not enough information to answer this question.

11. The average density of material ***A*** is approximately $\mathbf{2.5 \times 10^{-27}\ kg/m^3}$. What is the volume of a gold sample, $\boldsymbol{\rho = 19\ 300\ kg/m^3}$, that has the same mass as $\mathbf{8.0 \times 10^{24}\ m^3}$ of material ***A***?

(A) 1.0×10^{-6} m^3 (B) 5.0×10^{-5} m^3 (C) 1.0×10^{-4} m^3
(D) 2.0×10^{-5} m^3 (E) 8.0×10^{-5} m^3

12. Blood pressure is normally greater in your

(A) ears. (B) hands. (C) knees.
(D) feet. (E) not enough information to estimate the pressure.

13. The type of heat transfer that occurs between warm food and the air in the room is principally

(A) convective (B) conductive (C) radiative
(D) boiling (E) evaporating

14. An object is totally submerged in a pool of water, as the object continues to fall down in the water, the buoyant force

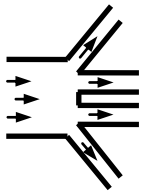
(A) increases with depth. (B) decreases with depth. (C) remains the same.
(D) depends on the mass of the object.
(E) depends on the weight of the object.

15. The coefficient of linear expansion of lead is $\mathbf{29 \times 10^{-6}\ K^{-1}}$. What change in temperature will cause a ***10 m*** long lead bar to change in length by ***3.0 mm***?

(A) 5.0 K. (B) 15 K. (C)20 K. (D) 10 K. (E) 25 K.

16. Water is flowing through a channel that is 12 m wide with a speed of 0.75 m/s. The water then flows into four identical channels that have a width of 4.0 m. The depth of the water does not change as it flows into the four channels. What is the speed of the water in one of the smaller channels?

(A) 0.56 m/s (B) 0.75 m/s
(C) 2.3 m/s (D) 0.12 m/s
(E) 0.25 m/s



17. Three thermometers are placed in a closed, insulated box and are allowed to reach thermal equilibrium. One is calibrated in Fahrenheit degrees, one in Celsius degrees, and one in Kelvins. The Celsius thermometer reads **–40 °C** and the Kelvin thermometer reads **233 K**. Which one of the following statements is necessarily true?

(A) The Kelvin thermometer should read –233 K.
(B) The Kelvin thermometer should read –313 K.

(C) The Fahrenheit thermometer must read –40 °F.
(D) If water were found within the box, it must be in the liquid state.
(E) If the temperature of the contents is increased by 10 C°, the reading on the Kelvin thermometer should increase by 273 K.

18. Phase changes occur?

(A) as the temperature decreases. (B) as the temperature increases.
(C) as the temperature remains the same. (D) all of the above.
(E) non of the above.

19. The two ends of an iron rod are maintained at different temperatures. The amount of heat that flows through the rod by conduction during a given time interval ***does not*** depend upon

(A) the length of the iron rod. (B) the mass of the iron rod.
(C) the thermal conductivity of iron.
(D) the duration of the time interval.
(E) the temperature difference between the ends of the rod.

20. A good reflector of radiation is a

(A) good absorber of radiation. (B) good emitter of radiation.
(C) poor absorber of radiation. (D) all of the above
(E) none of the above.

21. The silver coating on the glass surfaces of a Thermos bottle reduces energy that is transferred by

(A) conduction. (B) convection. (C) radiation.
(D) friction. (E) none of the above.

22. To turn **50 g** of boiling water to steam requires

(A) 50 kcalories. (B) 5 kcalories. (C) 540 calories.
(D) 270 calories. (E) 27 kcalorie.

End of Part 1

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.

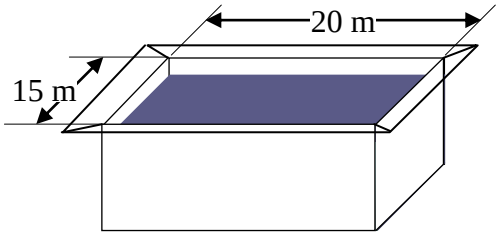
P.1. A **0.140 kg** baseball is dropped from rest from a height of **2.00 m** above the ground. What is the magnitude of its momentum just before it hits the ground?

Answer (with units)_____

P.2. A car is traveling at **7.0 m/s** when the driver applies the brakes. The car moves **1.5 m** before it comes to a complete stop. If the car had been moving at **14 m/s**, how far would it have continued to move after the brakes were applied? Assume the braking force is constant.

***Answer (with units)*_____**

P.3. A swimming pool has the dimensions shown in the drawing. It is filled with water to a uniform depth of **8.00 m**. The density of water **= 1.00 × 10^3 kg/m^3**. What is the water's pressure and the total force exerted on the bottom of the swimming pool?



***Answer(with units)*_____**

P. 4. When a block of volume **1.00 × 10^{-3} m^3** is hung from a spring scale as shown in **Figure A**, the scale reads **10.0 N**. When the same block is then placed in an unknown liquid, it floats with **2/3** of its volume submerged as suggested in **Figure B**. The density of water is **1.00 × 10^{-3} kg/m^3**.

Determine the mass of the block and the density of the unknown liquid.

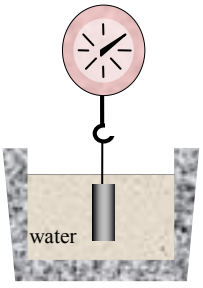


Figure A

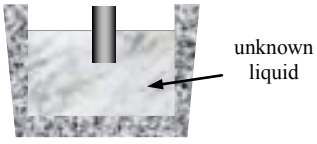


Figure B

Answer (with units)_____

P. 5. A mixture of **30.2 g** of sand and **87.7 g** of water has a temperature of **12.1°C**. What mass of water at **85.8°C** must be added to raise the final temperature of the mixture to **29.3°C**?

Answer_____

Some useful constants:

g=10 m/s^2 ρ_{water} **= 1 gm/cm^3** **1.0 cal = 4.18 J**

c_{water} **= 4190 J/ kg. ^{0}C = 4.19 J/g. ^{0}C ≈ 1.0 cal/g.^{0}C**

c_{sand} **= 2010 J/ kg. ^{0}C = 2.01 J/g. ^{0}C ≈ 0.48 cal/g.^{0}C**

c_{steam} **= 2010 J/ kg. ^{0}C = 0.48 cal/g.^{0}C**

c_{ice} **= 2090 J/ kg. ^{0}C = 0.5 cal/g.^{0}C**

L_{fusion} **for water or ice = 335 J/g = 33.5 x 10^4 J/kg = 80 cal/g**

$L_{vaporization}$ **for water = 2256 J/g = 22.56 x 10^5 J/kg = 540 cal/g**

$L_{condensation}$ **for steam = 2256 J/g = 22.56 x 10^5 J/kg = 540 cal/g**

Good Luck