Part 1.

Please read each question carefully. Each question worth's 1 point. For the following questions, please circle ◯ the correct answer.

1. One object that has twice as much mass as another object also has twice as much

A) inertia B) velocity C) gravitational acceleration
D) volume E) all of the above.

2. A **300 kg** bear holding a vertical tree slides down at constant velocity. The friction force between the tree and the bear is

A) 3 N B) 30 N C) 300 N D) 3000 N C) 0 N.

3. A sheet of paper can be withdrawn from under a milk carton without dropping it if the paper is pulled quickly. This best demonstrates that

A) the milk carton has no acceleration.
B) gravity tends to hold the milk carton secure.
C) the milk carton has inertia.
D) there is an action–reaction pair of forces.
E) not enough information to estimate the speed.

4. 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) 20 N. B) 10 N. C) 0 N . D) 15 N. E) 5 N.

5. The average momentum in (**kg.m/s)** of a **700 N** runner who covers **400 m** in **50 s** is

A) 5600. B) 87.5. C) 28.5. D) 285.7. E) 560.

6. An apple falls from a tree and hits the ground **5 m** below. It hits the ground with a speed of about

A) 5 m/s. B) 10 m/s. C) 15 m/s. D) 20 m/s.
E) not enough information.

7. A bullet is dropped into a river from a very high bridge. At the same time, a second bullet is fired from a gun, straight down towards the water from the bridge. Neglecting air resistance, the acceleration just before striking the water

A) is greater for the dropped bullet. B) is greater for the fired bullet.
C) is the same for both bullets. D) depends on how high they started.
E) none of the above

8. An object released from rest on another planet in outer space requires **1.0 s** to fall a distance of **6.0 m.** What is the acceleration (in $\mathbf{m/s^2}$) due to gravity on this planet?

A) 3. B) 6. C) 10. D) 12. E) 15.

9. A satellite in an elliptical orbit travels at constant

A) velocity. B) speed. C) acceleration. D) all of the above.
E) none of the above.

10. A heavy pile driver starting from rest falls on a pile with a force that depends on the

A) original height of the driver. B) original potential energy of the driver.
C) distance the pile falls. D) all of these. E) none of these.

11. A ball is thrown horizontally from the top of a tall cliff. Three seconds later, the ball has fallen a vertical distance of

A) 20 m. B) 30 m. C) 45 m. D) 90 m.
E) depends on the initial horizontal velocity of the ball.

12. The density of a submerged submarine is about the same as the density of

A) a fish. B) iron. C) a floating submarine. D) water.
E) not enough information to decide.

13. A bubble of air released from the bottom of a lake

A) rises to the top at constant volume. B) becomes smaller as it rises.
C) becomes larger as it rises. D) expands and contracts as it rises.
E) none of the above.

14. Which temperature scale labels the freezing point of water at **0 degrees**?

A) Celsius. B) Caloric. C) Kelvin. D) Fahrenheit.
E) none of the above.

15. Pour (empty) a liter of water at **40°C** into a liter of water at **20°C** and the final temperature of the two becomes

A) 35°C. B) 60°C. C) 30°C. D) 25°C.
E) not enough information to solve the problem.

16. Suppose you put a closed, sealed can of air on a hot stove burner. The contained air will undergo an increase in

A) thermal energy. B) temperature. C) pressure.
D) A and B only E) all of the above.

17. During a very cold winter, water pipes sometimes burst. The reason for this is

A) the ground contracts when colder, pulling pipes apart.
B) water expands when freezing. C) water contracts when freezing.
D) the freezing process releases pressure on the pipes. E) none of the above.

18. A good absorber of radiation is a

A) good emitter of radiation. B) poor emitter of radiation.
C) good reflector. D) poor reflector. E) none of the above.

19. A **5.0-g** sample of ice at **0.0 °C** falls through a distance of **20.0 m** and undergoes a completely inelastic collision with the earth. If all of the mechanical energy is absorbed by the ice, how much of it melts?

A) 2.9×10^{-3} g B) 2.39×10^{-4} g C) 2.1×10^{-2} g
D) 4.3×10^{-3} g E) 1.8×10^{-2} g

20. The number of grams of ice that can be melted by **1 g** of **100°C** steam is

A) 0.125 g B) 0.148 g C) 6.75 g D) 8.0 g E) none of the above.

21. Complete the following statement: Most of the heat that is lost to space from the earth occurs by

A) conduction. B) convection. C) radiation.
D) both conduction and radiation. E) both conduction and convection.

22. Absolute zero on the Celsius temperature scale is **–273.15 °C**. What is absolute zero on the Fahrenheit temperature scale?

A) –331.67 °F. B) –395.67 °F. C) –459.67 °F.
D) –363.67 °F. E) –427.67 °F.

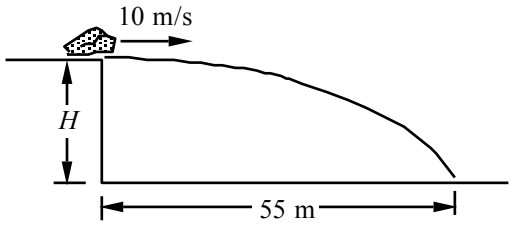
Part 2:

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.***

P.1. A **710 N** man stands on a bathroom scale in an elevator. What does the scale read if the elevator is ascending (moving up) with an acceleration of **3.0 m/s^2**?

***Answer*_____**

P.2. A rock is kicked *horizontally* at a speed of **10 m/s** from the edge of a cliff. The rock strikes the ground **55 m** from the foot of the cliff of height ***H*** as suggested in the figure, which is not drawn to scale. Neglect air resistance. What is the value of ***H***, the height of the cliff?



***Answer*_____**

P.3. A copper plate has a length of **0.12 m** and a width of **0.10 m** at **25 °C**. The plate is uniformly heated to **175 °C.** If the linear expansion coefficient for copper is $\mathbf{1.7 \times 10^{-5}/C°}$, what is the *change* in the area of the plate as a result of the increase in temperature?

***Answer*_____**

P. 4. In an insulated container, **0.50 kg** of steam, initially at **140 °C**, is mixed with **2.0 kg** of ice, initially at **–20.0 °C**. What is the final temperature inside the container if heat exchanges with the container are ignored?

***Answer*_____**

P. 5. A car of mass **1200 kg** with an initial velocity of **25 m/s**. What is the breaking force needed to stop the car in **12 s**?

***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 =1.0 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 = 541 cal/g

L $_{condensation}$ for steam = 2256 J/g = 22.56 x 10^5 J/kg = 541 cal/g

Good Luck