Part 1: 22 Multiple Choice Questions (1 mark each)

Use: The acceleration of gravity g = 10 m/s^2 and

The universal gravitational constant G = 6.67x10^{-11} N.m^2/kg^2.

The density of pure water = 1 g/cm^3 = 1000 kg/m^3

1) Which one of the following terms is used to indicate the natural tendency of an object to remain at rest or in motion at constant velocity?

a) inertia   b) weight   c) force   d) mass   e) acceleration

2) Which of the following statements is true about an object that moves with constant speed in a straight line?

a) The net force acting on the object is zero.

 b) A net force acts on the object opposite to the direction of motion.

c) A single constant force acts on the object in the direction of motion.

d) No forces act on the object.

e) None of these.

3) The average velocity and the instantaneous velocity of an object will be the same if

a) the object's speed is constant.   b) the object's acceleration is zero.

c) the object's velocity is positive.   d) the object's velocity is negative.

e) They are never the same.

4) When an object undergoes acceleration

a) its speed always increases.

b) its velocity always increases.

c) it always falls towards the Earth.

d) a net force always acts on it.

e) its direction always changes.

5) A skydiver is falling through the air. The air resistance he encounters at a certain point is 3/4 his weight. What is his acceleration at this point?

a) 10 m/s^2 b) 7.5 m/s^2 c) 2.5 m/s^2 d) 3.33 m/s^2 e) zero

6) Mass and weight

a) both measure the same thing.   b) are exactly equal.

c) are two different quantities.   d) are both measured in kilograms.

e) are both measured in Newton.

7) Starting from rest, a 4 kg body reaches a speed of 8 m/s in 2 s. What is the net force acting on the body?

a) 2 N   b) 4 N   c) 8 N   d) 16 N   e) 32 N

8) A stone is thrown straight up. At the top of its path, the net force acting on it is

a) greater than its weight.

b) greater than zero, but less than its weight.

c) equal to zero.

d) equal to its weight.

e) equal 10 m/s^2.

9) A rocket is able to accelerate in the vacuum of space when it fires its engines. The force that propels the rocket is the force

a) of the engine

b) by the exhaust gases on the rocket.

c) of the rocket on the exhaust gases.

d) both a and b

e) none of these

10) How long must a 100 N net force act to produce a change in momentum

   of 200 kg.m/s?

a) 0.25 s   b) 0.5 s   c) 2 s   d) 4 s   e) 1 s

11) A 10 g bullet travelling horizontally at 755 m/s strikes a stationary target and stops after penetrating 14.5 cm into the target. What is the average force on the bullet by the target?
a) 1.97×10^4 N.
b) 2.07×10^4 N.
c) 6.26×10^4 N.
d) 3.13×10^4 N.
e) 3.93×10^4 N.

12) When a bullet is fired from a gun, the gun recoils so both the bullet and gun are set in motion. The gun and the bullet ideally have equal
a) velocities
b) amounts of kinetic energy.
c) amounts of mechanical energy.
d) magnitudes of momentum.
e) none of these.

13) When the brakes are applied, a car moving at 15 m/s skids 30 m before stopping. How far will the same car skid after applying the brakes if it is traveling at 45 m/s?

a) 30 m   b) 90 m   c) 120 m   d) 270 m   e) 15 m

14) When an object is lifted 7 m up, it gains a certain amount of potential energy. If the

same object is lifted 14 m, its potential energy gain is

a) more than four times as much.

b) twice as much.

c) four times as much.

d) less.

e) the same.

15) What is the mechanical energy of a 70 kg man running at 6 m/s at the top of an 8 m high building?
a) 1260 J   b) 5600 J   c) 6860 J   d) 4840 J   e) 2900 J

16) An airplane flies at a constant speed of 40 m/s at an altitude of 50 m. The pilot drops a heavy package, which falls and strikes the ground. Where, approximately, does the package land?
a) 500 m behind the plane
b) 400 m behind the plane
c) more than 500 m behind the plane
d) beneath the plane
e) none of these

17) If the Sun were twice as far, its pull on earth would be
a) unchanged   b) twice as much   c) half as much
d) four times as much   e) one fourth as much

18) Consider three drinking glasses. All three have the same base area, and all three are filled to the same depth with water. Glass A is cylindrical. Glass B is wider at the top than at the bottom, and so holds more water than A. Glass C is narrower at the top than at the bottom, and so holds less water than A. Which glass has the greatest liquid pressure at the bottom?
a) Glass A   b) Glass B   c) Glass C
d) all three have equal pressure   e) none of the above

19) If a piece of cotton is compressed, then
a) its mass is increased.   b) its mass is decreased.
c) its density is increased.   d) its density is decreased.
e) none of these

20) The pressure at the bottom of a swimming pool does not depend on
a) the acceleration of gravity.
b) the density of water.
c) the surface area of the swimming pool.
d) the depth of water in the swimming pool.
e) none of these.

21) A block suspended by a weighing scale weighs 54 N out of water and 37 N when submerged in water. The buoyant force on the rock is

a) 37 N   b) 54 N   c) 17 N   d) 91 N   e) 540 N

22) The pressure in a closed container is 1800 kPa when its volume is 0.225 Liter. What is the new pressure when the container has inflated at constant temperature to a volume of 1.35 Liter?

 a) 900 kPa   b) 300 kPa   c) 600 kPa   d) 10800 kPa   e) 5400 kPa

Part 2: Solve the following four problems in the space provided in between showing all your steps.

Problem 1 (5 marks): A person pushes with a horizontal force of 120 N on a 16 kg shopping cart for a distance of 22 m. A 48.0 N frictional force opposes the motion of the cart.

Determine the work done by

a) the pushing force

b) the frictional force

c) the gravitational force

Problem 2 (6 marks): Given that the mass of earth is 6×10^{24} kg and its radius

is 6380 km,

a) Find the weight of a 70 kg man when he is at 2500 km above earth surface.

b) Use your answer to part (a) to calculate the acceleration of gravity at that height.

Problem 3 (6 marks): A steel ball is lunched horizontally from the top of a table top at a speed of 4 m/s. If it takes 0.5 s for the ball to hit the ground,

a) find the height of the table

b) how far from the base of the table will the ball hit the ground?

Problem 4 (6 marks): A block of wood of volume 800 cm^3 and density 0.75 g/cm^3 floats at the surface of a salty sea water. If the piece of wood displaces 500 cm^3 of water, find

a) The buoyant force on the piece of wood.

b) The density of the salty sea water.