**Forces – Study Guide**

This is a list of the concepts that will be covered before the test and are all considered fair game. To properly prepare you should do the following questions AND review all notes, practice problems and worksheets.

1) Fg = mg

The weight of an object is the Fg between it and Earth (or whatever planet its on). Use this formula when on Earth, g = 9.80 m/s2

2) Fg = Gm1m2/r2

A Fg will exist between any two masses. Remember, r is the distance between the **centers** of mass.

3) g = Gm/r2

The gravitational field strength of a given mass is the same as the acceleration due to gravity that it creates. **See #2 about r.**

4) Newton’s 1st Law: An object in motion will stay in motion and an object at rest will stay at rest until an outside force acts upon it.

5) Newton’s 2nd Law: An unbalanced force creates an acceleration, Fnet = ma

6) Newton’s 3rd Law: For every action force there is an equal and opposite reaction force.

7) Free Body Diagrams: Be able to draw FBD given an example. Represent all forces as arrows coming from the centre of a box.

8) FN: On a horizontal surface (with no acceleration) FN = Fg = mg

9) Ff = uFN, if velocity is constant then Ff = Fapp, if accelerating then use Fnet

10) Pulley Question: Find the acceleration of both masses using mtotal.

11) The Elevator Question: Find the apparent weight (FN) of an object that is accelerating upwards (**heavier**) or downwards (*lighter*).

12) FE = k∆x

**Practice Test Questions**

1) How much does a 78.0 kg student weigh

 a) on Earth (g = 9.81 m/s2)?

 b) on the moon (g = 1.60 m/s2)?

2) An astronaut weighs 2328 N on Jupiter (g = 24.5 m/s2).

 a) What is his mass on Jupiter?

 b) What is his mass on Earth?

3) A 5.00 x 104 kg shuttle is orbiting the Earth 2.45 x 107 m above its surface.

 a) What is the Earth’s gravitational field strength at this height?

 b) What is the force of gravity between the shuttle and the Earth?

4) Planet X has a mass of 7.32 x 1023 kg and a radius of 1.75 x 106 m. What is the acceleration due to gravity on its surface?

5) Two highly attractive physics students of identical mass sit 0.35 m apart and feel a gravitational force of 2.30 x 10-6 N. Find their masses.

6) A 7.05 x 106 kg destroyer and a 1.29 x 107 kg battleship float nearby in the water. If they exert 0.8396 N of gravitational force on each other, how far apart are they?

7) Describe how Newton’s 1st Law applies to each of the following situations:

 a) A curling rock glides along an a frictionless sheet of ice.

b) When blasting off, the astronauts in a space shuttle feel as though they are being crushed back into their seats.

c) You are drinking coffee while driving. When you come to a sudden stop, your coffee spills all over your lap.

8) A 7.2 block of wood is pushed with a net force of 18.2 N, find its acceleration.

9) A 775 kg truck accelerates at 4.25 m/s2. What is the net force exerted on the truck?

10) A hockey puck is accelerated along a frictionless surface. If a force of 12.4 N creates an acceleration of 16.6 m/s2, what is the mass of the puck?

11) As a 0.0225 kg bullet travels though the barrel of a gun it accelerates at 1.90 x 105 m/s2. If the applied force on the bullet is 5.00 x 103 N, what is the friction force acting on it?

12) Two students have a breakdown and are pushing their 955 kg car to the nearest service station. Student A can push with a force of 890 N and student B with a force of 770 N. Assuming no friction force, find the acceleration of the car:

a. if they are physics students who know that they should both push from the back.

b. they are biology students who decide that Student A should push on the back while Student B pushes on the front.

13) A 0.145kg baseball traveling at 35.0m/s strikes the catcher’s mitt which, in bringing the ball to rest, recoils backward 11.0cm. What was the average force applied by the ball on the glove?

14) Whew! That was a lot of work. Take a break, you deserve it.

15) Define Newton’s 3rd law and give examples.

16) In which situation is does student A exert more force?

 1 – When pushing on Student B with 500 N, who in turn pushes back with 500 N.

 2 – When pushing on a wall with 500 N.

17) A 20-kg box is gliding towards the right across the floor with an acceleration of

1 m/s2, left. Complete the free body diagram as follows:



Fnet = \_\_\_\_\_\_\_

18) Draw Free Body Diagrams for the following each of the following situations.

a. An apple falls from a tree.

b. Rudolph pulls the sleigh (all by himself) and accelerates to the right.

c. A skydiver is falling at a constant velocity.

d. A rocket blasts off and accelerates straight up.

e. A block of wood moves at a constant velocity to the right over a rough surface.

19) An 833 kg car is traveling at 80.0 km/h, when it comes to a sliding stop at a red light. The coefficient of friction for rubber sliding on asphalt is 0.41.

a. What is the deceleration of the car?

b. How far does the car travel before it stops?

20) A 112 kg sled is being pulled with a force of 325 N. Calculate the acceleration if:

a. the ground is frictionless.

b. the sled and the ground have a coefficient of friction of 0.132.

21) A student pushes a 105 kg cart with 713 N. If it accelerates at 6.00 m/s2, what is the coefficient if friction?



22) Two masses are attached by a weightless string over a frictionless pulley as shown. If m1 = 78 kg and m2 = 42 kg calculate:

a. The acceleration of m2 if the table is frictionless.

b. The acceleration of m1 if the table has a coefficient of friction = 0.465.

23) A 90.0 kg student is riding in an elevator. Determine his apparent weight when:

a. The elevator is at rest on the ground floor.

b. He starts to move upwards with an acceleration of 3.27 m/s2.

c. After 4 seconds he is moving upwards at 13.08 m/s.

d. At the top he slows down at 3.27 m/s2.