**The Four Fundamental Forces**

1. List the four fundamental forces and their main properties.
2. Which fundamental force holds the protons together in the nucleus of the atom?

**Net Force & Free Body Diagrams**

1. A heavy box is being pushed by one person and pulled by another person while it moves across the floor. Draw a free body diagram of all the forces acting on the box.
2. The engines of a plane exert a horizontal force of 37850 N North. A wind the the south also exerts a force of 850 N on the plane. What is the net horizontal force on the plane.
3. Four children are playing tug-of-war. The two children on the right pull with forces of magnitude 84 N and 86 N and one child on the left pulls with a force of magnitude 83 N. If the rope remains stationary, how hard is the second child on the left pulling?

**Newton's Three Laws of Motion**

1. Which object has more inertia: a feather or a book? In your own words, explain what it means for an object to have inertia.
2. In your own words, describe Newton's Third Law and give an example that demonstrates this law.
3. The engines of an airplane exert a net force of magnitude 800000 N during takeoff, causing the plane to accelerate at a rate of 8.0 m/s2. What is the mass of the plane?

**Gravitational Field Strength**

1. The Moon is much smaller than the Earth, so the gravitational field strength of the Moon is only about one-sixth that of the Earth.
   1. What is the acceleration due to gravity on the Moon?
   2. How much would a 72 Kg person weigh on the Moon?
   3. If an object falls with a force of 700 N [down] on Earth, what would be the force on the same object be if it fell on the Moon?

**Free Fall & Weightlessness**

1. A 3.0 Kg object hangs from a string inside an elevator. Calculate the tension on the string for the following situations:
   1. The elevator is stationary
   2. The elevator is accelerating at 1.2 m/s2 [Up]
   3. The elevator is accelerating at 1.4 m/s2 [Down]

**Newton's Universal Law of Gravitation**

1. Calculate the gravitational force between two students of mass 55 Kg and 75 Kg sitting 65 cm apart.
2. Object A experiences a gravitational force due to object B of 2.5x10-8 N.
   1. What is the force experienced by object B due to object A?
   2. What is the force if the separation distance is halved?
   3. What is the force of the mass of object A increases seven times?

**Static & Kinetic Friction**

1. An object experiences a friction force of 6.6 N and a normal force of 30.0 N.
   1. What is the coefficient of friction?
   2. Is the object moving? How do you know?
2. Two books of the same mass of 0.75 Kg are stacked, one on top of the other, on a table. The coefficient of static friction between the two books is 0.75 and the coefficient of kinetic friction between the bottom book and the table is 0.25.
   1. If a student pushes on the top book, what is the maximum force that can be applied that will allow the books to stay together when the move across the table?
   2. What is the maximum acceleration of the books?

**Additional Questions**:

1. Discuss how Newton’s Laws can be used to explain the function of transportation safety devices such as:   
   a) seatbelts b) headrests c)Speed limits on curved ramps
2. Discuss the variation of the Earth’s gravitational field with distance from the Earth’s centre. How will this affect the weight of objects measured at:
3. Sea level versus the equator
4. Sea level versus on top of a mountain
5. a)What is the difference between mass measured in kg and weight measured in Newtons?

b) Your friend says they want to lose weight. Is this what they really want to do? Please explain.

1. a) Discuss how friction can be both your friend and foe.

b) What is the difference between static and kinetic friction?