**Physics Year 10 – Forces 1: Aim to do questions 1-20 in week 1 and questions 21-36 in week 2**

**Forces and their interactions (P4.5.1)**

**Scalar and Vector quantities (P4.5.1.1)**

1. Scalar quantites have magnitude (size) ony.
2. Distance, speed, time, energy, power, are examples of scalar quantities
3. Vector quantities have a magnitude and a direction
4. Displacement, velocity, acceleration, force and momentum are examples of vectors
5. Vectors can be shown by arrows
6. The length of the arrow shows the magnitude (size) of the vector
7. The direction the arrow is pointing shows the direction of the vector.

**Contact and non-contact forces (P5.5.1.2)**

1. A force is a push or a pull
2. Forces  due to objects touching are known as **contact forces**
3. Friction, air resistance, tension and normal contact force are all examples of contact forces
4. Forces which happen without physics contact are **non-contact forces**
5. Gravitational force (weight),  electrostatic force and magnetic force are all examples of non-contact forces
6. The vector arrow for weight always points towards the centre of the earth

**Gravity (P4.5.1.3)**

1. Gravity is a non-contact force which acts between any two masses.
2. The size of the force increases when the masses get closer together or if the size of the masses increase.
3. Weight is the force acting on an object due to gravity
4. Weight in measured in newtons because it is a force
5. Weight depends on the gravitational field strength at the point where the object is.
6. The weight is calculated using  weight = mass x gravitational field strength   W = m x g
7. Gravitational field strength has units N/kg

**Resultant forces (P4.5.1.4)**

1. The resultant force is the one single force which has the same effect as a number of different forces acting at a point.
2. Free body diagrams show all the forces acting on an object
3. A single force can be split into two components at right angles to each other
4. A body in equilibrium has no resultant force acting on it.

Answer the following questions – some research may be needed

1. Write down the names of 8 scalar quantities
2. Write down the names of 6 vector quantities
3. Explain the difference between a contact force and a non-contact force, giving examples
4. Download the simulation below:

<https://phet.colorado.edu/en/simulation/gravity-force-lab-basics>

Draw a table with headings as below

|  |  |
| --- | --- |
| Mass 2 (billion kg) | Force N |

Set mass 1 to 1 billion kg and the distance to 5km and tick the ‘constant size’ box

Complete the table using the simulation for 10 different values of Mass 2.

1. In this investigation, what is the independent variable?
2. What is the dependent variable?
3. Name 2 control variables?
4. Using excel or a similar graphing package, plot a graph of Force vs Mass 2
5. Write a conclusion about how the size of Mass2 affects the force
6. Now set both masses to 5 billion kg and investigate the effect of changing the distance between the two masses by dragging the masses (max 9.6km)
7. Draw up a table to record your data in. Take 10 equally spaced readings.
8. What is the range of your readings?
9. What is the resolution of the distance scale?
10. What is the independent variable in this investigation?
11. What is the dependent variable in this investigation?
12. What are the control variables?
13. Plot a graph of the distance between the masses and the force on the masses.
14. Draw a best fit line – remember it doesn’t have to be straight!
15. Write a conclusion, giving as much detail as possible.
16. *Extension: Plot a second graph of Force vs 1/distance2 and make a conclusion
Research the equation for the gravitational force between 2 masses and explain if the equations supports the data you have collected from both investigations you have carried out. Use your data to support your answer.*
17. Research the strength of gravity (the gravitational field strength) on different planets in our solar system. Draw a table showing the diameter of the planet, the mass of the planet and the gravitational field strength.
18. Look at this data carefully and describe any patterns you can see.
19. Find the value of the gravitational field strength on the moon and find out why the moon has no atmosphere.
20. Watch the following youtube clip :
<https://www.youtube.com/watch?v=W2aBVbcHr_k>
21. Make notes about mass and weight, including the equation.
22. Write down the units of mass
23. Write down the units of weight
24. Write down what you would say if you were explaining the difference between mass and weight to a primary school child.
25. Calculate the weight of a 2kg mass on the earth. (g = 9.8N/kg)
26. Calculate the weight of a 25kg mass on the earth.
27. Calculate the mass of a rock which has a weight of 200N on the earth
28. Calculate the weight of a 25kg mass on the moon (g = 1.6N/kg)
29. On a distant planet, the weight of a 500kg mass is 375N. Calculate the gravitational field strength on this planet. Will this planet have a larger or smaller mass than the mass of the earth? Explain your answer – (think about other possible factors)
30. Now watch and make careful notes on the following youtube clips
<https://www.youtube.com/watch?v=PL8ATKipoB4> - resultant forces
<https://www.youtube.com/watch?v=PG8wV022Eu0> – resultants of perpendicular forces
31. Draw a free body diagram for a helicopter, of weight 2000N, hovering at a constant height.
32. Calculate the resultant of these forces: 400N

a. 18N 6N b. 100N 200N c. 600N

1. Watch the clip and carefully describe and explain what you see in terms of the forces.
 <https://www.youtube.com/watch?v=E43-CfukEgs>