**2014 q6**

**Compare vector and scalar quantities.**

**Give one example of each. (8)**

Vectors have both magnitude and direction. Examples are force, velocity and displacement

Scalars only have magnitude. Examples are mass and speed.

**Describe an experiment to find the resultant of two vectors. (9)**



**Method:**

Set up apparatus as shown.

Note the readings on the first two Newton-meters, F1 and F2

Note the reading on the on the third meter, Fr

**Observation:**

According to Newton’s third law, Fr should be equal in magnitude but opposite in direction to the resultant of the two upper meters.

In this way you have experimentally measured the value of that resultant

**A golfer pulls his trolley and bag along a level path. He applies a force of 277 N at an angle of 24.53° to the horizontal. The weight of the trolley and bag together is 115 N and the force of friction is 252 N.**

**Calculate the net force acting on the trolley and bag. (9)**

**What does the net force tell you about the golfer’s motion? (3)**

We can resolve the 277N force into vertical and horizontal components

277N

 FV

24.53o

FH

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Also, ****

In terms of net forces, the total forwards force is 252N, and the friction force, which is acting in the opposite direction, is also 252N. This means that the net force on the trolley is 0 N.

A force of 0 N will create an acceleration of 0 N. This indicates that the golfer is walking at a constant speed.

(a more exact calculated value is 251.99909N which suggest that the trolley would be slowing down, but this would be imperceptible)

**Use Newton’s second law of motion to derive an equation relating force, mass and acceleration. (9)**

Newton’s second law states that the rate of change of a body’s momentum is proportional to the force which causes it and takes place in the direction of that force.

From the second law, we can see that force is proportional to the change in a body’s momentum:

i.e., for a body of mass m, changing from a velocity v to one of u**:**

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As this is the formula which is used to define the unit of force, the Newton, we can choose a value for k, and choose the value of 1, yielding:

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**A force of 5.3 kN is applied to a golf ball by a club. The mass of the ball is 45 g and the ball and club are in contact for 0.54 ms.**

**Calculate the speed of the ball as it leaves the club. (9)**

Using to find *a:*

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 Using the equations of motion:

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**The ball leaves the club head at an angle of 15° to the horizontal. Calculate the maximum height reached by the ball. Ignore the effect of air resistance. (9)**

**The vertical velocity can be found with vector analysis:**

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Looking only at vertical motion, and recalling that at the highest point, the velocity is zero:

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**This gives:**

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**(acceleration due to gravity, *g* = 9.8 m s–2)**