Scalar and Vector Quantities

Question Paper

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.5 Forces
Sub-Topic	Scalar and Vector Quantities
Difficulty Level	Gold Level
Booklet	Question Paper

Time Allowed: **29 minutes**

Score: **/27**

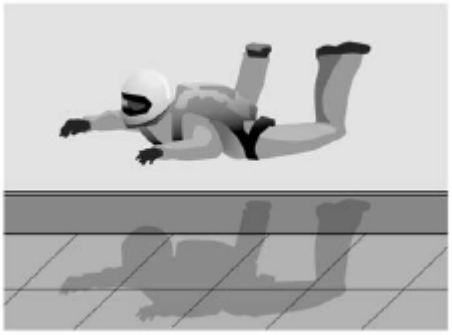
Percentage: **/100**

Grade Boundaries:

Q1.Figure 1 shows a skydiver training in an indoor wind tunnel.

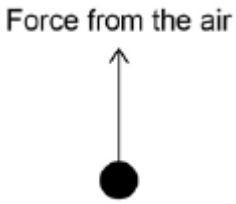
Large fans below the skydiver blow air upwards.

Figure 1



(a) The skydiver is in a stationary position.

Complete the free body diagram for the skydiver.



(2)

(b) The skydiver now straightens his legs to increase his surface area.

This causes the skydiver to accelerate upwards.

Explain why straightening his legs cause the skydiver to accelerate upwards.

.....

.....

.....

.....

(2)

(c) A small aeroplane used for skydiving moves along a runway.

The aeroplane accelerates at 2 m / s^2 from a velocity of 8 m / s.

After a distance of 209 m it reaches its take-off velocity.

Calculate the take-off velocity of the aeroplane.

.....

.....

.....

Take-off velocity = ... m / s

(3)

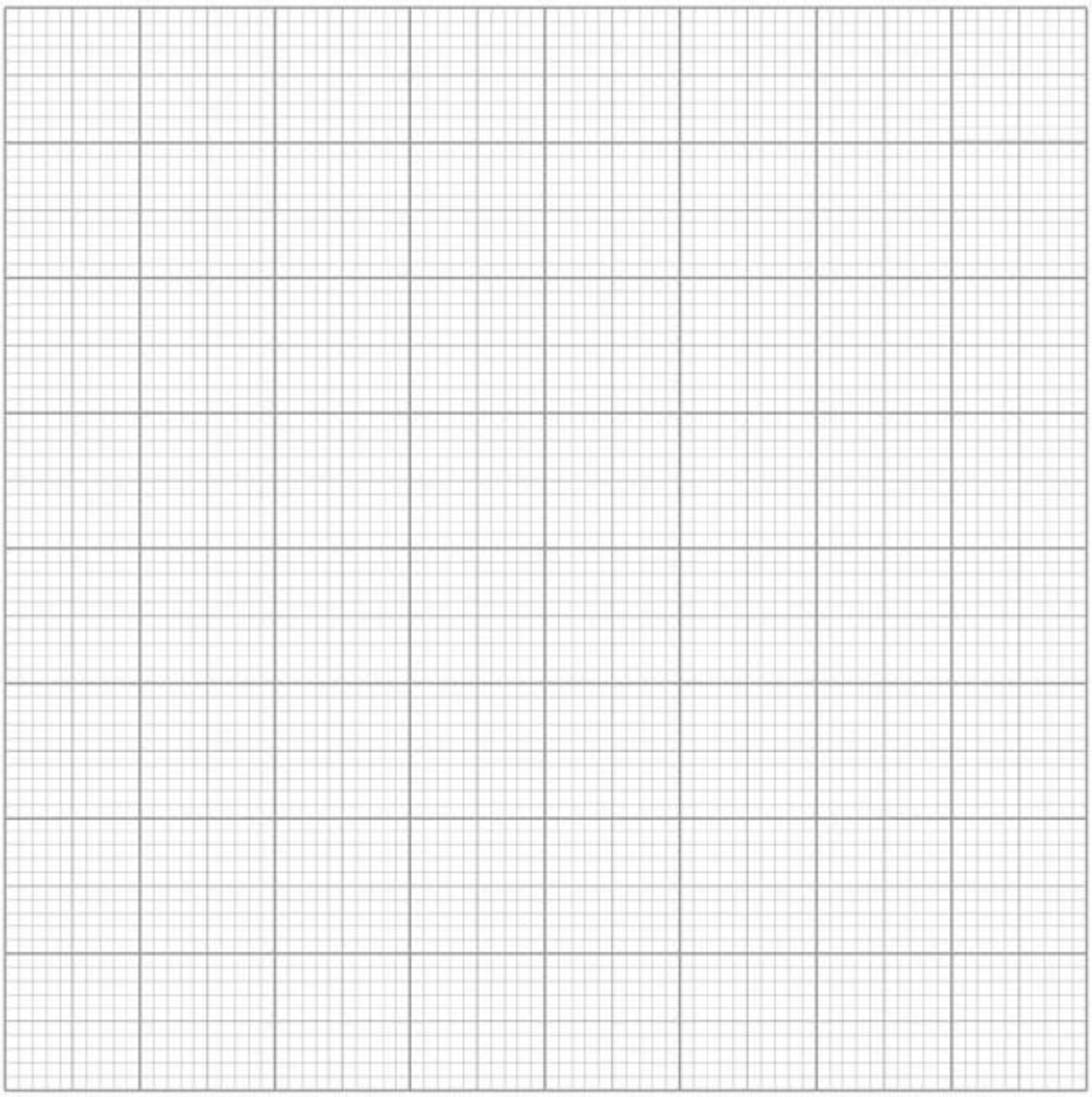
(d) A skydiver jumps from an aeroplane.

There is a resultant vertical force of 300 N on the skydiver.

There is a horizontal force from the wind of 60 N.

Draw a vector diagram on **Figure 2** to determine the magnitude and direction of the resultant force on the skydiver.

Figure 2



Magnitude of resultant force = ... N

(5)

(Total 12 marks)

Q2. This question is about forces, quantities and vectors.

(a) Write down the equation that links gravitational field strength, mass and weight.

.....

(1)

(b) A small ball weighs 1.4 N.

gravitational field strength, g = 9.8 N / kg

Calculate the mass of the ball.

.....

.....

.....

Mass = ... kg

(3)

(c) A white ball with mass 143 g is moving at a velocity of 7.9 m / s.

It collides with a red ball with mass of 150 g.

The red ball is stationary before the collision. The white ball stops after the collision.

Calculate the velocity of the red ball after the collision.

Give your answer to two significant figures.

.....

.....

.....

.....

.....

.....

Velocity of red ball = ... m / s

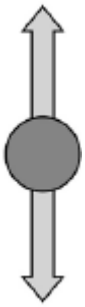
(4)

(d) The white ball is thrown high into the air.

After it is released the ball moves up and then back down in a vertical line.

The free body force diagram in the figure below shows the forces on the ball at one point in its flight.

The force arrows are drawn to scale.



Explain what is happening to the ball at this point in its flight.

.....

.....

.....

.....

.....

.....

.....

.....

(4)
(Total 12 marks)

Q3. The London Eye is one of the largest observation wheels in the world.

The passengers ride in capsules. Each capsule moves in a circular path and accelerates.

(a) Explain how the wheel can move at a steady speed and the capsules accelerate at the same time.

.....

.....

.....

(2)

(b) In which direction is the resultant force on each capsule?

.....

(1)

(c) The designers of the London Eye had to consider **three** factors which affect the resultant force described in part (b).

Two factors that increase the resultant force are:

- an increase in the speed of rotation
- an increase in the total mass of the wheel, the capsules and the passengers.

Name the other factor that affects the resultant force and state what effect it has on the resultant force.

.....

.....

(1)

(Total 4 marks)