

# 1.3 Vectors & Scalars

## Question Paper

Course	DPIB Physics
Section	1. Measurement & Uncertainties
Topic	1.3 Vectors & Scalars
Difficulty	Easy

**Time allowed:** 60  
**Score:** /46  
**Percentage:** /100

### Question 1a

(a)

State the definition of a vector quantity.

[2]

[2 marks]

### Question 1b

A list of vector quantities and their SI unit is given.

Quantity	SI unit
Acceleration	
	K
Mass	

(b)

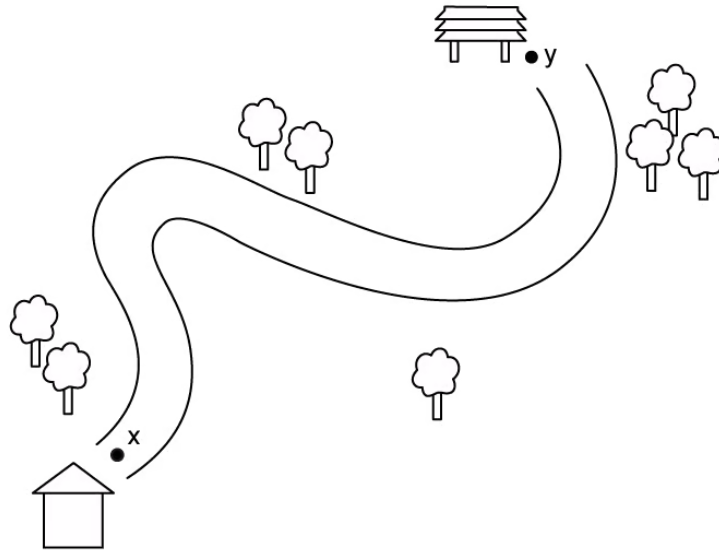
Complete the information missing from the table.

[3]

[3 marks]

### Question 1c

Lindsay cycles along a path every day, from her front garden at X to a bench by the nearby lake at Y.



(c)

(i)

Sketch a line on the image that would indicate the distance travelled by Lindsay between X and Y. Label this distance  $d$ .

[2]

(ii)

State whether the distance travelled  $d$  by Lindsay is greater than, equal to, or less than her displacement between X and Y.

[1]

[3 marks]

### Question 1d

(d)

Lindsay cycles along the same path back home, from Y to X. The total distance logged by her smartwatch is 2.4 km. State and explain what the total displacement for her journey is.

[2]

**[2 marks]****Question 2a**

(a)

Describe what happens to the magnitude of a vector when it is

(i)

multiplied by an integer greater than 1.

[1]

(ii)

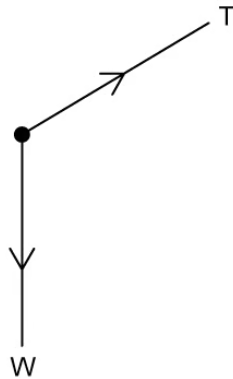
multiplied by a negative number.

[1]

**[2 marks]**

### Question 2b

An incomplete free body force diagram for a painting hanging by special wires in equilibrium is shown.



Three forces act on the painting.

(b)

(i)  
Complete the free body force diagram by sketching the additional force vector required for equilibrium.

[2]

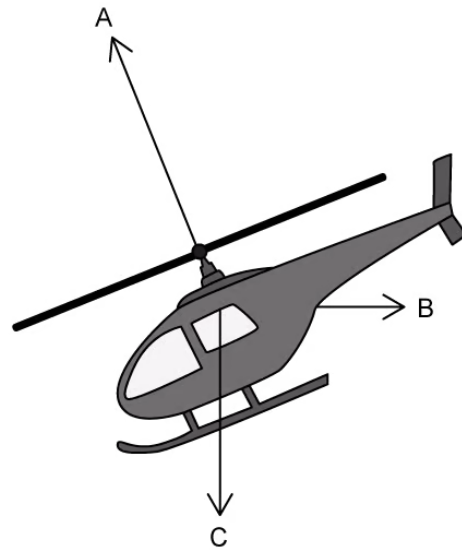
(ii)  
State the name of the force you have drawn.

[1]

**[3 marks]**

### Question 2c

A helicopter is moving horizontally through the air. Three forces act on the helicopter, A, B and C.



(c)  
State the name of each of the three forces A, B and C.

[3]

[3 marks]

### Question 2d

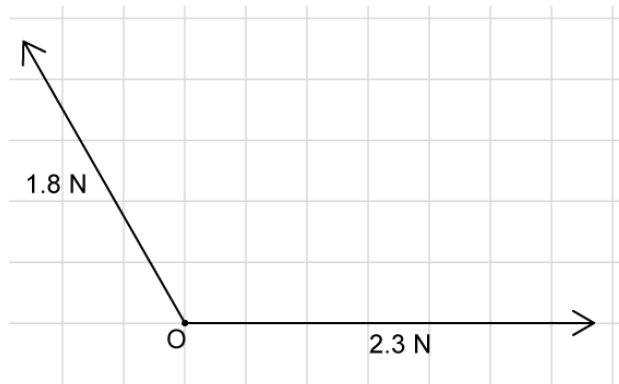
(d)  
State and explain the direction of horizontal motion for the helicopter shown in part (c).

[2]

[2 marks]

### Question 3a

Two vectors act on an object at O. The length of each square on the grid is 1 cm.



(a)

Determine the scale used to draw the diagram, including an appropriate unit.

[3]

[3 marks]

### Question 3b

(b)

Complete the scale drawing by drawing an appropriate parallelogram on the grid in part (a) to show the resultant force on the object at O.

[2]

[2 marks]

### Question 3c

(c)

Hence, by measuring the resultant vector drawn in part (b), determine the amount of force it represents.

[2]

[2 marks]

### Question 3d

(d)

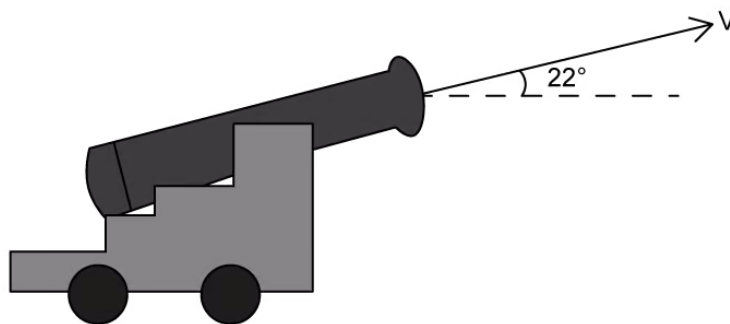
The 1.8 N force now acts vertically upwards, such that the two forces acting on the object at O are perpendicular. Calculate the magnitude of the new resultant force acting on the object at O.

[2]

[2 marks]

### Question 4a

A small cannon is designed to fire projectiles at an angle of  $22^\circ$  to the horizontal with an initial velocity  $v$ .



(a)

Calculate the vertical component of velocity if its initial velocity  $v = 10 \text{ m s}^{-1}$ .

[2]

[2 marks]



### Question 4b

(b)

State the direction of the horizontal component of velocity.

[1]

[1 mark]

### Question 4c

(c)

State and explain why the horizontal component of velocity stays constant in the absence of air resistance.

[2]

[2 marks]

### Question 4d

The vertical component of the projectile's velocity decreases to zero.

(d)

(i)

State the point along the projectile's journey at which its vertical component of velocity is zero.

[1]

(ii)

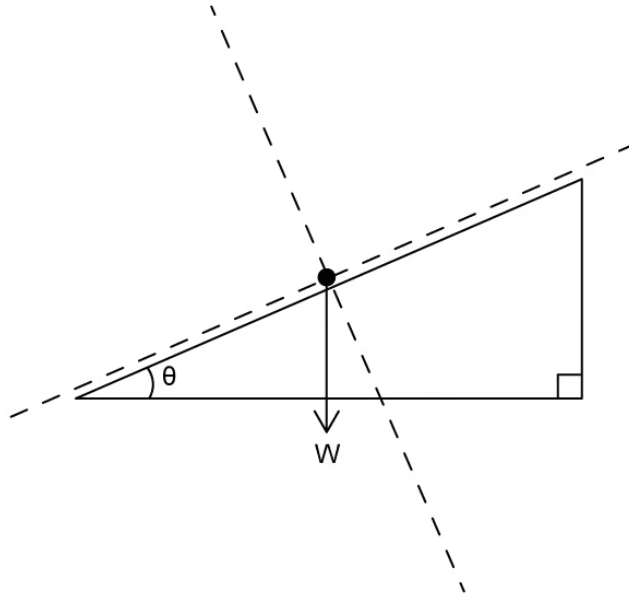
Explain why the projectile's vertical component of velocity decreases to zero.

[2]

[3 marks]

### Question 5a

An object of weight  $W$  is at rest on an inclined plane.



(a)

Using an appropriate parallelogram, draw the components of the weight  $W$  along the axes shown.

[3]

[3 marks]

### Question 5b

(b)

Write an expression for the magnitude of the component of weight acting parallel to the slope.

[1]

[1 mark]

### Question 5c

(c)

Draw the normal reaction force on the object in part (a) and label it  $R$ .

[2]

[2 marks]

### Question 5d

(d)

Identify the third force acting on the object and describe its direction with respect to the slope.

[3]

[3 marks]