Mixed Exercise - 2

1.

(a) Define a *vector quantity*.

……

…… **[1]**

(b) Circle all the vector quantities in the list below.

acceleration speed time displacement weight **[1]**

(c) Fig. 1.1 shows graphs of velocity v against time t for two cars **A** and **B** travelling along a straight level road in the same direction.

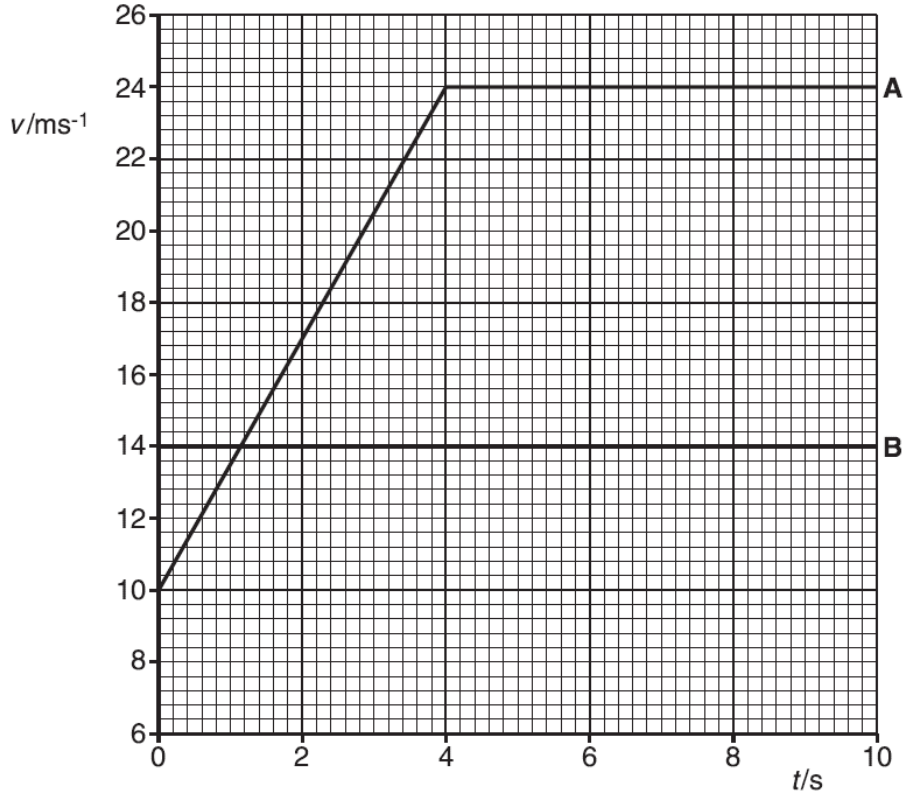

Fig. 1.1

At time $t = 0$, both cars are side-by-side.

(i) Describe the motion of car **A** from $t = 0$ to $t = 10$ s.

……

……

…… **[2]**

(ii) Calculate the distance travelled by car **A** in the first 4.0 s.

distance = ... m **[2]**

(iii) Use Fig. 1.1 to find

1 the time at which both cars have the same velocity

time = ... s **[1]**

2 the time *t* at which car **A** overtakes car **B**.

t = ... s **[2]**

2

(a) State a similarity and a difference between *distance* and *displacement*.

(i) similarity: .....

..... **[1]**

(ii) difference: .....

..... **[1]**

(b) Fig. 1.1 shows two airports **A** and **C**.

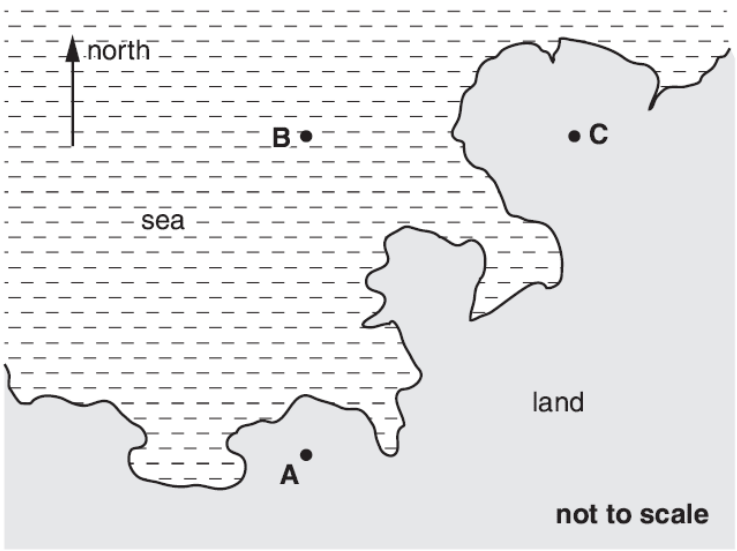

Fig. 1.1

An aircraft flies due north from **A** for a distance of 360 km (3.6×10^5 m) to point **B**.
Its average speed between **A** and **B** is 170 m s^{-1}. At **B** the aircraft is forced to change course and flies due east for a distance of 100 km to arrive at **C**.

(i) Calculate the time of the journey from **A** to **B**.

time = ... s **[1]**

(ii) Draw a labelled displacement vector triangle below. Use it to determine the magnitude of the displacement in km of the aircraft at **C** from **A**.

displacement = ... km **[3]**

3.

Fig. 2.1 shows a graph of velocity against time for an object travelling in a straight line.

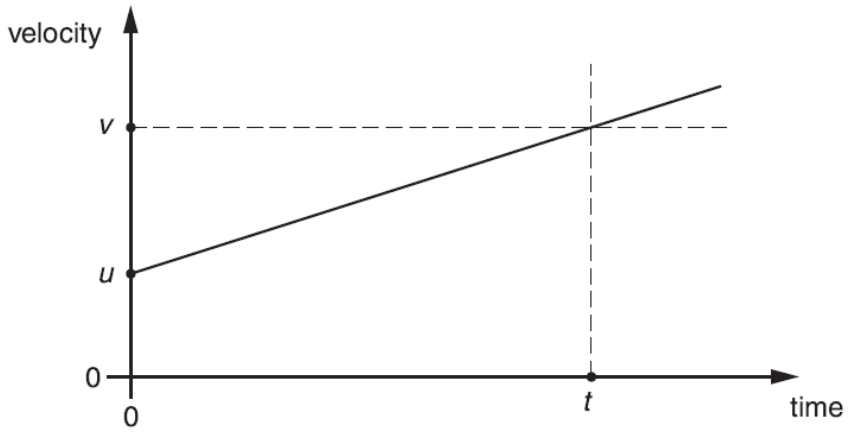

Fig. 2.1

The object has a constant acceleration *a*. In a time *t* its velocity increases from *u* to *v*.

(a) Describe how the graph of Fig. 2.1 can be used to determine

(i) the acceleration *a* of the object

In your answer, you should use appropriate technical terms, spelled correctly.

.....

..... **[1]**

(ii) the displacement *s* of the object.

.....

..... **[1]**

(b) Use the graph of Fig. 2.1 to show that the displacement *s* of the object is given by the equation:

$$s = ut + \frac{1}{2}at^2$$

[2]

(c) In order to estimate the acceleration *g* of free fall, a student drops a large stone from a tall building. The height of the building is known to be 32 m. Using a stopwatch, the time taken for the stone to fall to the ground is 2.8 s.

(i) Use this information to determine the acceleration of free fall.

acceleration = ... $m\,s^{-2}$ **[2]**

(ii) One possible reason why your answer to **(c)(i)** is smaller than the accepted value of $9.81\,m\,s^{-2}$ is the reaction time of the student. State another reason why the answer is smaller than $9.81\,m\,s^{-2}$.

.....

..... **[1]**

4

Draw a line from each unit on the left-hand side to the correct equivalent unit on the right-hand side.

joule (J)	$kg\,m\,s^{-2}$
watt (W)	N m
newton (N)	$J\,s^{-1}$

[2]

5

(a)

Fig. 4.1 shows the velocity vector for a particle moving at an angle of 31° to the horizontal.

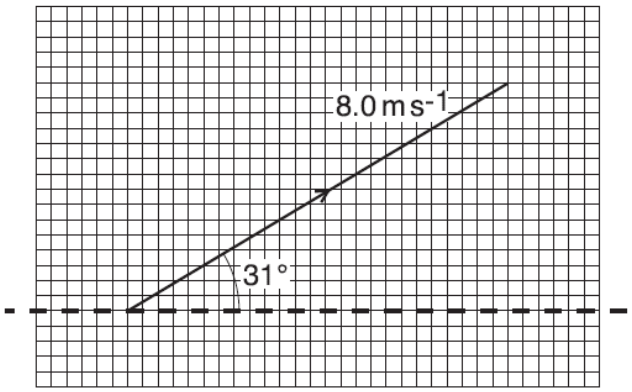

Fig. 4.1

(i) On Fig. 4.1, show the horizontal (*x*-direction) and vertical (*y*-direction) components of the velocity. **[2]**

(ii) Calculate the horizontal (*x*-direction) component of the velocity.

velocity = ... $m s^{-1}$ **[1]**

(b)

Fig. 4.2 shows a ship **S** being pulled by two tug-boats.

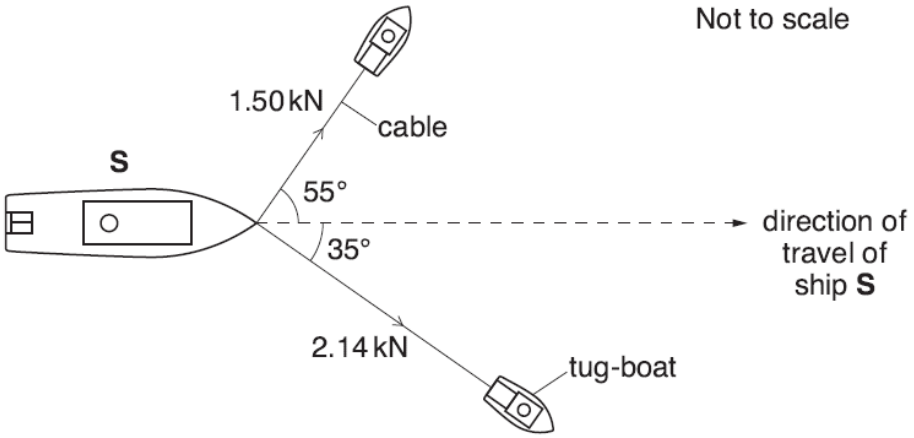

Fig. 4.2

The ship is travelling at a constant velocity. The tensions in the cables and the angles made by these cables to the direction in which the ship travels are shown in Fig. 4.2.

(i) Draw a vector triangle and determine the resultant force provided by the two cables.

resultant force = ... kN **[3]**

(ii) State the value of the drag force acting on the ship **S**. Explain your answer.

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.....

..... **[2]**

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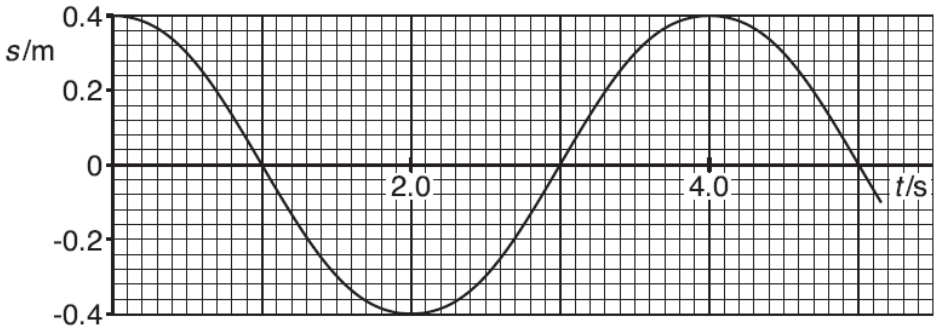
6. During an experiment on oscillations one end of a spring is fixed to a point on a roof and a mass is hung vertically from the other end. The mass is pulled down and then released. The diagram below shows the displacement *s* against time *t* graph for the mass.



Use the graph to determine the **maximum** speed of the mass.