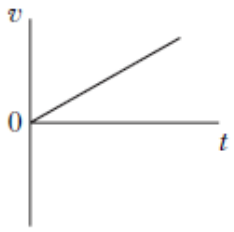
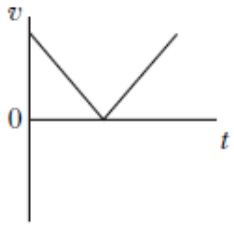
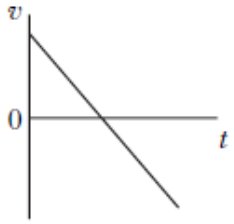
Exercise 1 - Scalar and Vector

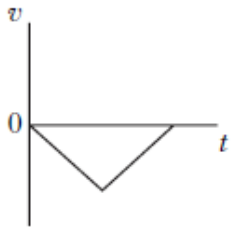
Past Paper Homework Questions

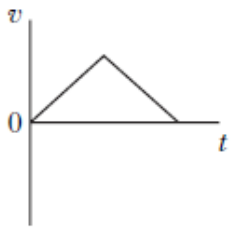
1. A ball is thrown vertically upwards and falls back to Earth. Neglecting air resistance, which velocity-time graph represents its motion?

A 

B 

C 

D 

E 

2. Which row shows both quantities classified correctly?

	Scalar	*Vector*
A	weight	force
B	force	mass
C	mass	distance
D	distance	momentum
E	momentum	time

3. Which of the following contains one scalar quantity and one vector quantity?

A acceleration; displacement

B kinetic energy; speed

C momentum; velocity

D potential energy; work

E power; weight

4. Acceleration is the change in

A distance per unit time

B displacement per unit time

C velocity per unit distance

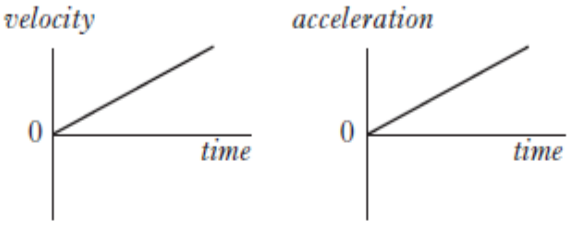
D speed per unit time

E velocity per unit time.

5. A vehicle is travelling in a straight line. Graphs of velocity and acceleration against time are shown.

Which pair of graphs could represent the motion of the vehicle?

A



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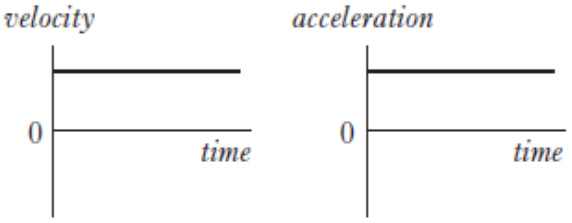

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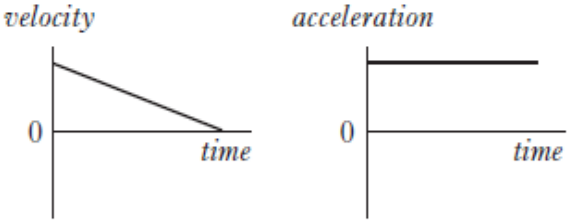
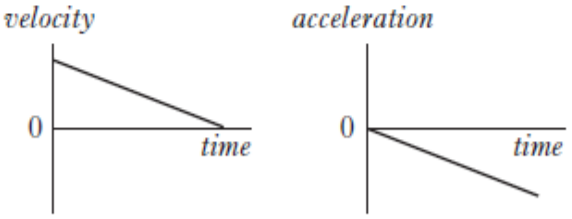
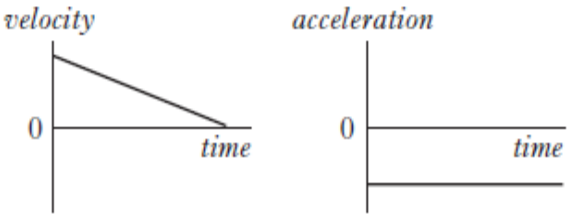


D

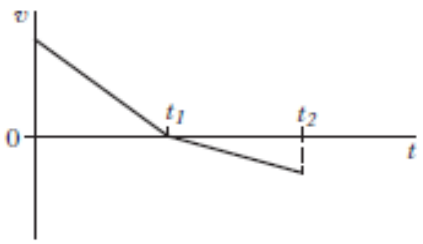


E



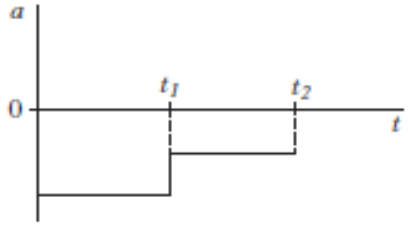
6. A trolley travels along a straight track.

The graph shows how the velocity v of the trolley varies with time t.

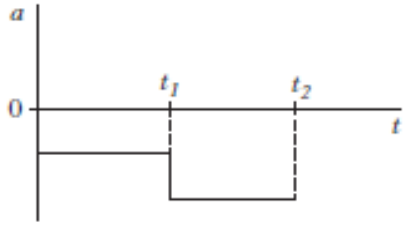


Which graph shows how the acceleration a of the trolley varies with time t?

A



B



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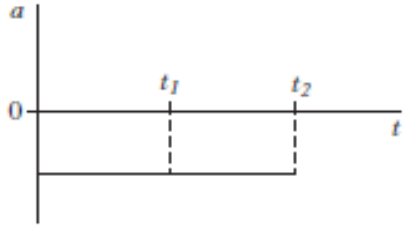

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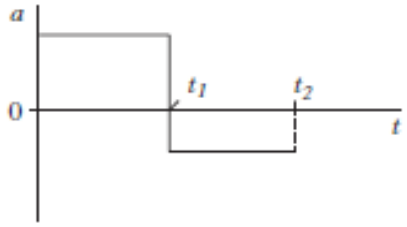
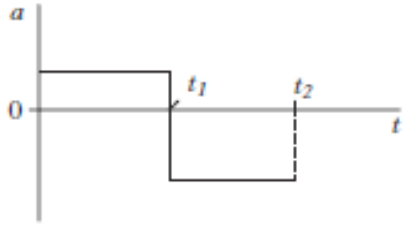


E



7. Which of the following is a vector quantity?

A distance

B time

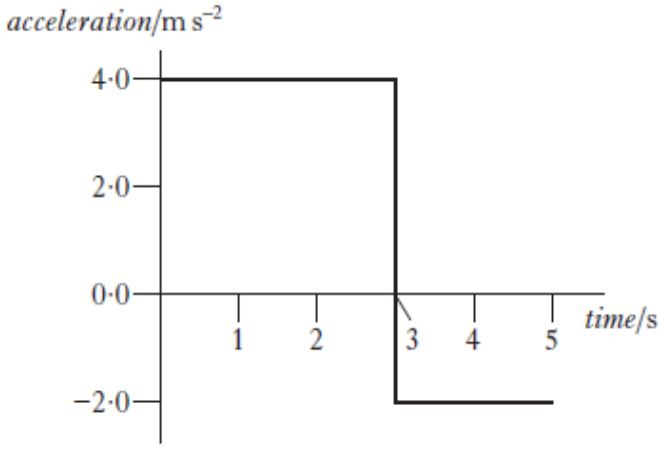
C speed

D energy

E weight

8. An object starts from rest and accelerates in a straight line.

The graph shows how the acceleration of the object varies with time.



The speed of the object at 5 seconds is

A $2\,m\,s^{-1}$

B $8\,m\,s^{-1}$

C $12\,m\,s^{-1}$

D $16\,m\,s^{-1}$

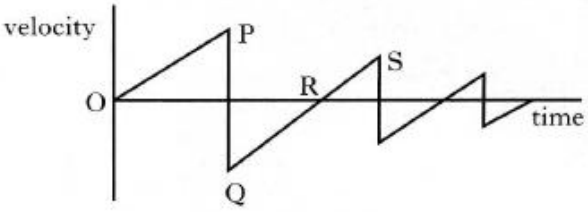
E $20\,m\,s^{-1}$.

9. A woman walks 12 km due North. She then turns round immediately and walks 4 km due South. The total journey takes 4 hours.

Which row in the following table gives the correct values for her average velocity and average speed?

	Average velocity	*Average speed*
A	$4\,km\,h^{-1}$ due N	$4\,km\,h^{-1}$
B	$4\,km\,h^{-1}$ due N	$2\,km\,h^{-1}$
C	$3\,km\,h^{-1}$ due N	$4\,km\,h^{-1}$
D	$2\,km\,h^{-1}$ due N	$4\,km\,h^{-1}$
E	$2\,km\,h^{-1}$ due N	$3\,km\,h^{-1}$

10. The following velocity-time graph describes the motion of a ball, dropped from rest and bouncing several times.



Which of the following statements is/are true?

I The ball hits the ground at P.

II The ball is moving upwards between Q and R.

III The ball is moving upwards between R and S.

A I only

B II only

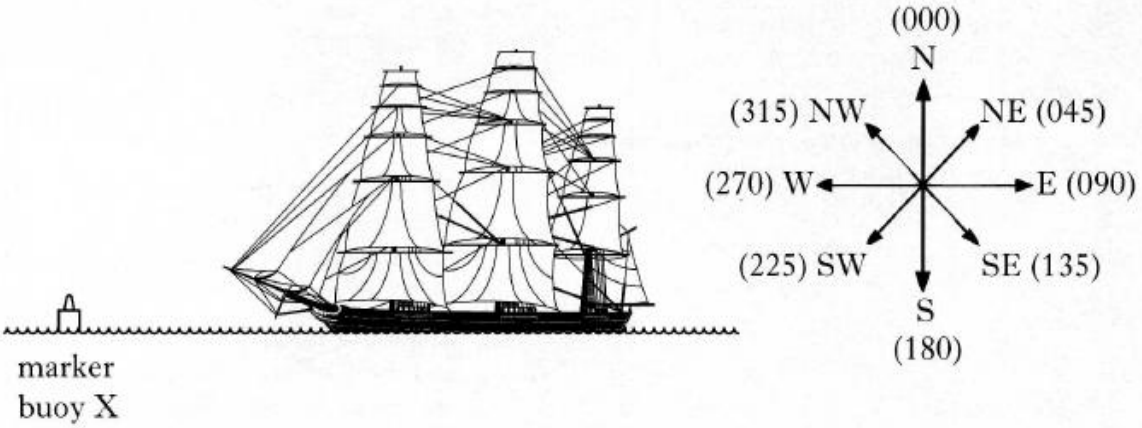
C III only

D I and II only

E I and III only

11. (*a*) State the difference between speed and velocity. **1**

(*b*) During a tall ships race, a ship called the Mir passes a marker buoy X and sails due West (270). It sails on this course for 30 minutes at a speed of $10{\cdot}0\,\text{km}\,\text{h}^{-1}$, then changes course to 20° West of North (340). The Mir continues on this new course for 1½ hours at a speed of $8{\cdot}0\,\text{km}\,\text{h}^{-1}$ until it passes marker buoy Y.



(i) Show that the Mir travels a total distance of 17 km between marker buoys X and Y.

(ii) By scale drawing or otherwise, find the displacement from marker buoy X to marker buoy Y.

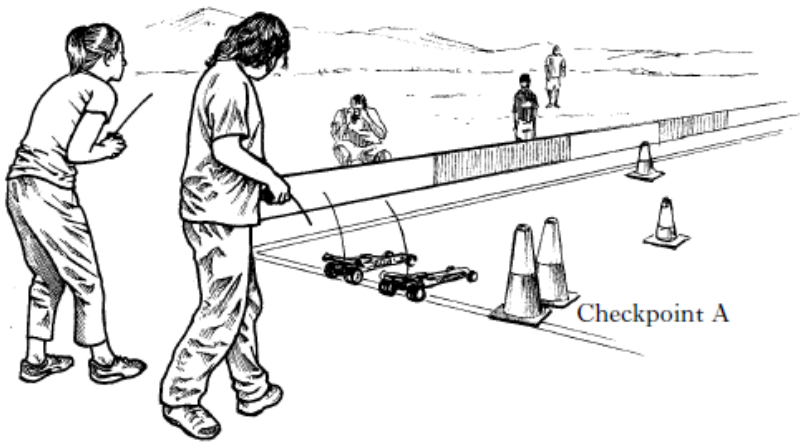
(iii) Calculate the average velocity, in $\text{km}\,\text{h}^{-1}$, of the Mir between marker buoys X and Y. **6**

(*c*) A second ship, the Leeuvin, passes marker buoy X 15 minutes after the Mir and sails directly for marker buoy Y at a speed of $7{\cdot}5\,\text{km}\,\text{h}^{-1}$.

Show by calculation which ship first passes marker buoy Y. **2**

(9)

12. Competitors are racing remote control cars. The cars have to be driven over a precise route between checkpoints.



Each car is to travel from checkpoint A to checkpoint B by following these instructions.

"Drive 150 m due North, then drive 250 m on a bearing of 60° East of North (060)."

Car X takes 1 minute 6 seconds to follow these instructions exactly.

(*a*) By scale drawing or otherwise, find the displacement of checkpoint B from checkpoint A. **2**

(*b*) Calculate the average velocity of car X from checkpoint A to checkpoint B. **2**

(*c*) Car Y leaves A at the same time as car X.

Car Y follows exactly the same route at an average speed of $6{\cdot}5\ \text{m s}^{-1}$.

Which car arrives first at checkpoint B?

Justify your answer with a calculation. **2**

(*d*) State the displacement of checkpoint A from checkpoint B. **1**

(7)

13. A helicopter is flying at a constant height above the ground. The helicopter is carrying a crate suspended from a cable as shown.

(*a*) The helicopter flies 20 km on a bearing of 180 (due South). It then turns on to a bearing of 140 (50° South of East) and travels a further 30 km.

The helicopter takes 15 minutes to travel the 50 km.

(i) By scale drawing (or otherwise) find the resultant displacement of the helicopter. **2**

(ii) Calculate the average velocity of the helicopter during the 15 minutes. **2**

(4)

30 marks