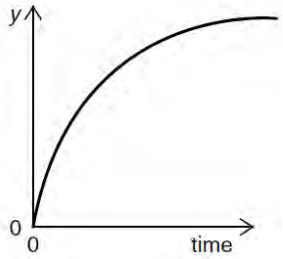
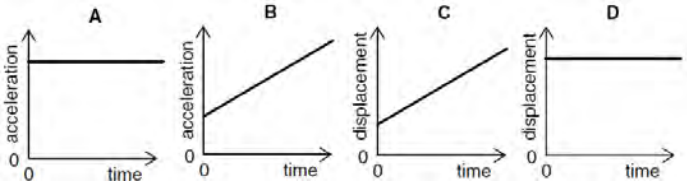
Kinematics

1. The graph relates to the motion of a falling body.

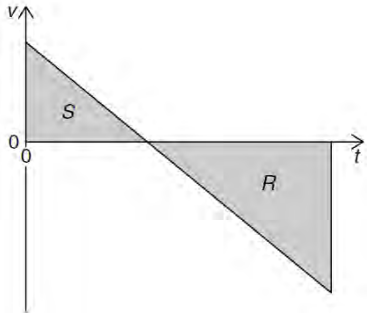


Which is a correct description of the graph?
A *y* is distance and air resistance is negligible
B *y* is distance and air resistance is not negligible
C *y* is speed and air resistance is negligible
D *y* is speed and air resistance is not negligible

2. Which graph represents the motion of a car that is travelling along a straight road with a uniformly increasing speed?

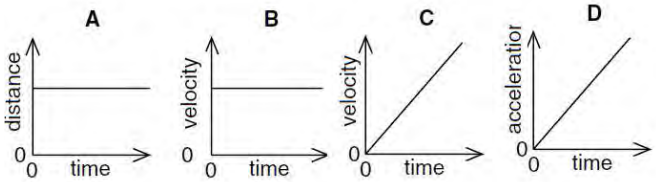


3. A stone is thrown upwards from the top of a cliff. After reaching its maximum height, it falls past the cliff-top and into the sea.
The graph shows how the vertical velocity *v* of the stone varies with time *t* after being thrown upwards. *R* and *S* are the magnitudes of the areas of the two triangles.

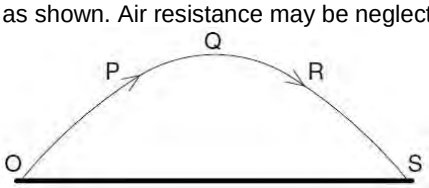


What is the height of the cliff-top above the sea?
A *R* **B** *S* **C** *R* + *S* **D** *R* – *S*

4. A particle is moving in a straight line with uniform acceleration.
Which graph represents the motion of the particle?

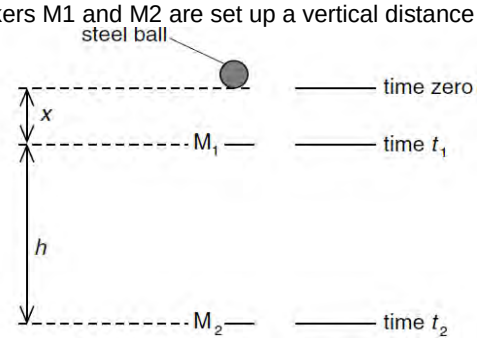


5. A projectile is launched at point O and follows the path OPQRS, as shown. Air resistance may be neglected.



Which statement is true for the projectile when it is at the highest point Q of its path?
A The horizontal component of the projectile's acceleration is zero.
B The horizontal component of the projectile's velocity is zero.
C The kinetic energy of the projectile is zero.
D The momentum of the projectile is zero.

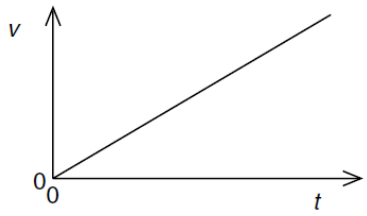
6. Two markers M1 and M2 are set up a vertical distance *h* apart.



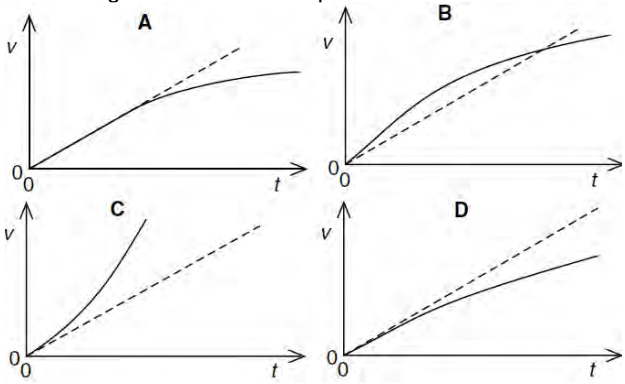
When a steel ball is released from rest from a point a distance *x* above M1, it is found that the ball
takes time *t*1 to reach M1 and time *t*2 to reach M2.
Which expression gives the acceleration of the ball?

A $\frac{2h}{t_2^2}$ **B** $\frac{2h}{(t_2 + t_1)}$ **C** $\frac{2h}{(t_2 - t_1)^2}$ **D** $\frac{2h}{(t_2^2 - t_1^2)}$

7. A body falls from rest in a vacuum near the Earth's surface. The variation with time *t* of its speed *v* is shown below.

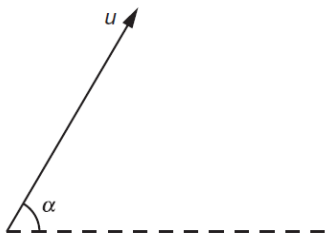


Which graph shows the variation with time *t* of the speed *v* of the same ball falling in air at the same place on Earth?



8. Which of the following is a scalar quantity?
A acceleration **B** mass **C** momentum **D** velocity

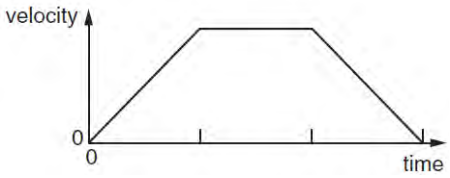
9. A projectile is fired at an angle α to the horizontal at a speed *u*, as shown.



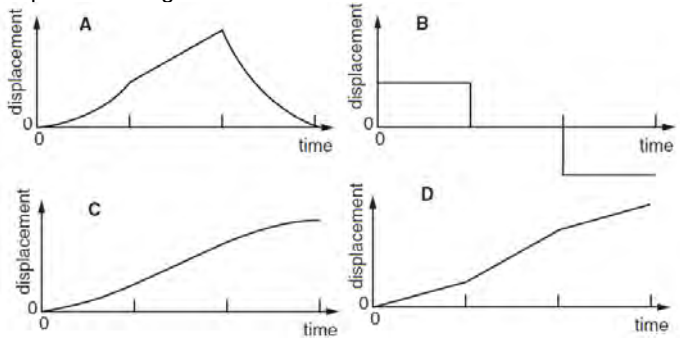
What will be the vertical and horizontal components of its velocity after a time *t* ?
Assume that air resistance is negligible. The acceleration of free fall is *g*.

	vertical component	horizontal component
A	$u \sin \alpha$	$u \cos \alpha$
B	$u \sin \alpha - gt$	$u \cos \alpha - gt$
C	$u \sin \alpha - gt$	$u \cos \alpha$
D	$u \cos \alpha$	$u \sin \alpha - gt$

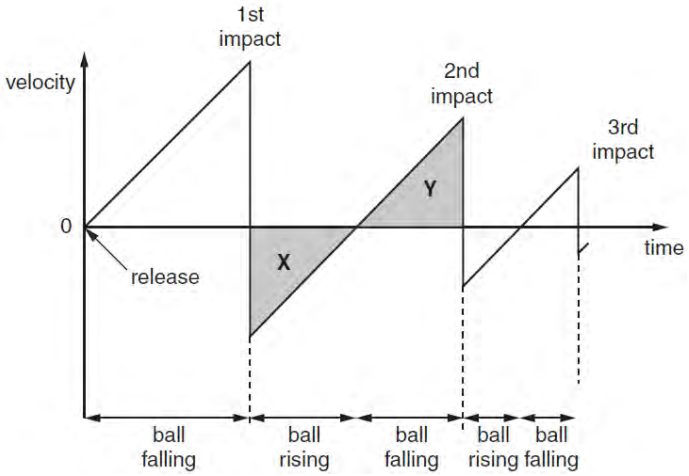
10. The graph of velocity against time for an object moving in a straight line is shown.



Which of the following is the corresponding graph of displacement against time?



11. A ball is released from rest above a horizontal surface. The graph shows the variation with time of its velocity.



Areas **X** and **Y** are equal. This is because

A the ball's acceleration is the same during its upward and downward motion.

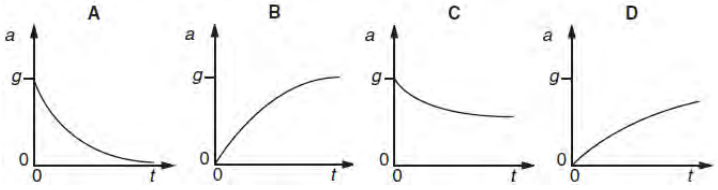
B the speed at which the ball leaves the surface after an impact is equal to the speed at which it returns to the surface for the next impact.

C for one impact, the speed at which the ball hits the surface equals the speed at which it leaves the surface.

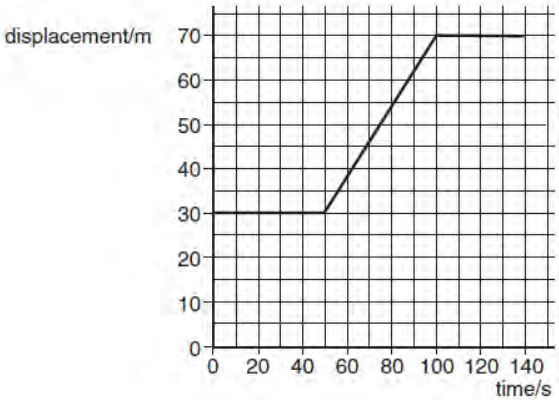
D the ball rises and falls through the same distance between impacts.

12. A motorist travelling at $10 ms^{-1}$ can bring his car to rest in a distance of 10 m.
If he had been travelling at $30 ms^{-1}$, in what distance could he bring the car to rest using the same braking force?
A 17 m **B** 30 m **C** 52 m **D** 90m

13. An object is dropped from a great height and falls through air of uniform density. The acceleration of free fall is *g*.
Which graph could show the variation with time *t* of the acceleration *a* of the object?



14. A car at rest in a traffic queue moves forward in a straight line and then comes to rest again. The graph shows the variation with time of its displacement.

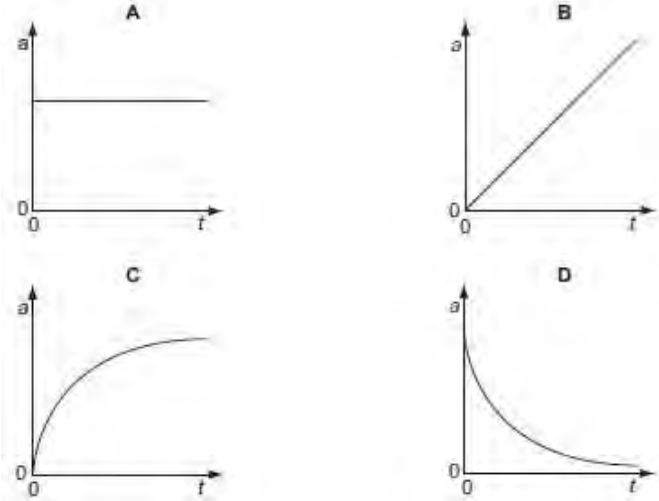


What is its speed while it is moving?
A $0.70 ms^{-1}$ **B** $0.80 ms^{-1}$ **C** $1.25 ms^{-1}$ **D** $1.40 ms^{-1}$

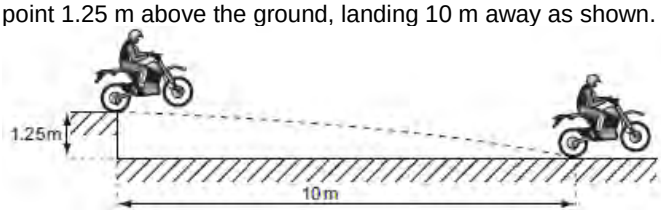
15. Which pair contains one vector and one scalar quantity?
A displacement : acceleration B force : kinetic energy
C momentum : velocity D power : speed

16. A car is travelling with uniform acceleration along a straight road. The road has marker posts every 100 m. When the car passes one post, it has a speed of 10 m s^{-1} and, when it passes the next one, its speed is 20 m s^{-1}.
What is the car's acceleration?
A 0.67 m s^{-2} B 1.5 m s^{-2} C 2.5 m s^{-2} D 6.0 m s^{-2}

17. A tennis ball is released from rest at the top of a tall building.
Which graph best represents the variation with time t of the acceleration a of the ball as it falls, assuming that the effects of air resistance are appreciable?

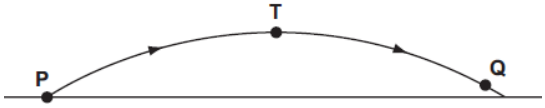


18. A motorcycle stunt-rider moving horizontally takes off from a point 1.25 m above the ground, landing 10 m away as shown.



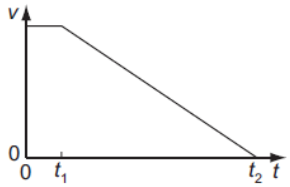
What was the speed at take-off?
A 5 m s^{-1} B 10 m s^{-1} C 15 m s^{-1} D 20 m s^{-1}

19. In the absence of air resistance, a stone is thrown from P and follows a parabolic path in which the highest point reached is T. The stone reaches point Q just before landing.

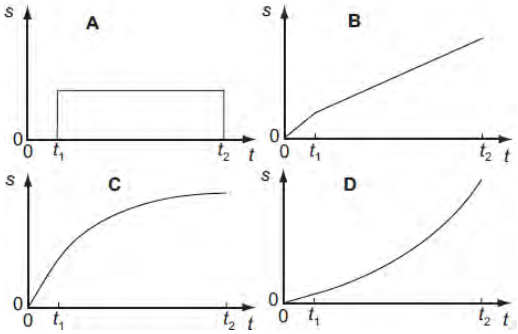


The vertical component of acceleration of the stone is
A zero at T. B greatest at T.
C greatest at Q. D the same at Q as at T.

20. When a car driver sees a hazard ahead, she applies the brakes as soon as she can and brings the car to rest. The graph shows how the speed v of the car varies with time t after the hazard is seen.



Which graph represents the variation with time t of the distance s travelled by the car after the hazard has been seen?



21. An object falls 10.0 m from rest before entering some water. Assuming negligible air resistance, what is the time taken to reach the water and the speed with which the object reaches the water?

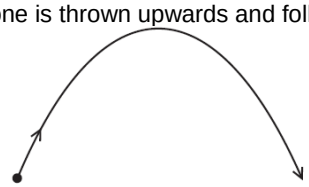
	time / ms	speed / ms^{-1}
A	1.02	10.0
B	1.02	14.0
C	1.43	10.0
D	1.43	14.0

22. Which feature of a graph allows acceleration to be determined?
A the area under a displacement-time graph
B the area under a velocity-time graph
C the slope of a displacement-time graph
D the slope of a velocity-time graph

23. A boy throws a ball vertically upwards. It rises to a maximum height, where it is momentarily at rest, and falls back to his hands. Which of the following gives the acceleration of the ball at various stages in its motion? Take vertically upwards as positive. Neglect air resistance.

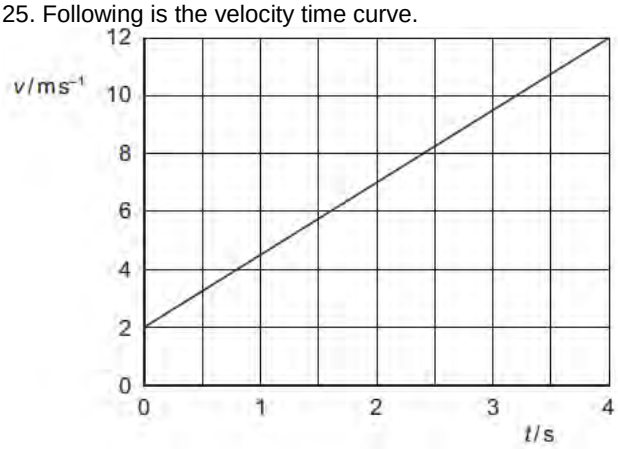
	rising	at maximum height	falling
A	$-9.81\,ms^{-2}$	0	$+9.81\,ms^{-2}$
B	$-9.81\,ms^{-2}$	$-9.81\,ms^{-2}$	$-9.81\,ms^{-2}$
C	$+9.81\,ms^{-2}$	$+9.81\,ms^{-2}$	$+9.81\,ms^{-2}$
D	$+9.81\,ms^{-2}$	0	$-9.81\,ms^{-2}$

24. A stone is thrown upwards and follows a curved path.



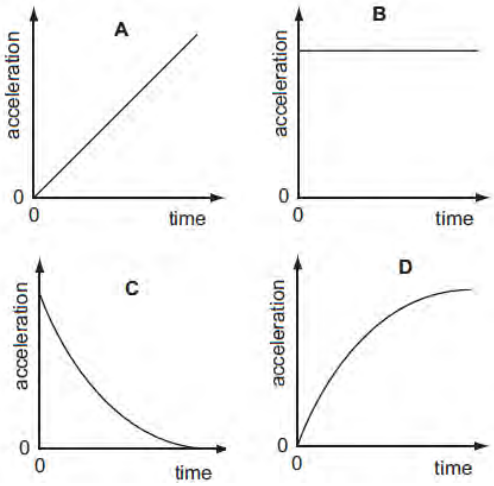
Air resistance is negligible. Why does the path have this shape?
A The stone has a constant horizontal velocity and constant vertical acceleration.
B The stone has a constant horizontal acceleration and constant vertical velocity.
C The stone has a constant upward acceleration followed by a constant downward acceleration.
D The stone has a constant upward velocity followed by a constant downward velocity.

25. Following is the velocity time curve.

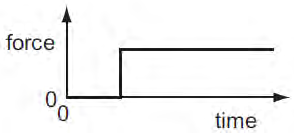


What is the distance travelled between time t = 0 and t = 4 s?
A 2.5 m B 3.0 m C 20 m D 28 m

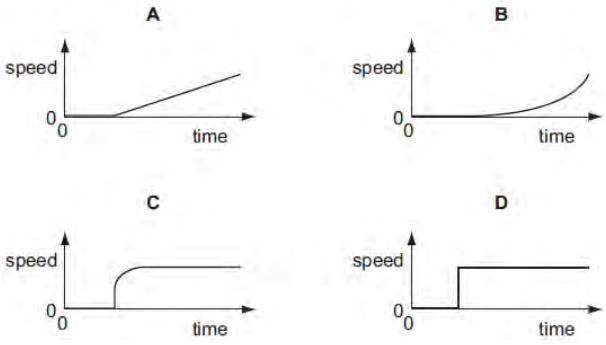
26. A football is dropped from the top of a tall building.
Which acceleration-time graph best represents the motion of the football through the air?



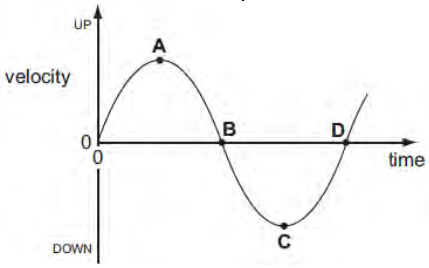
27. A car driver sharply presses down the accelerator when the traffic lights go green. The resultant horizontal force acting on the car varies with time as shown.



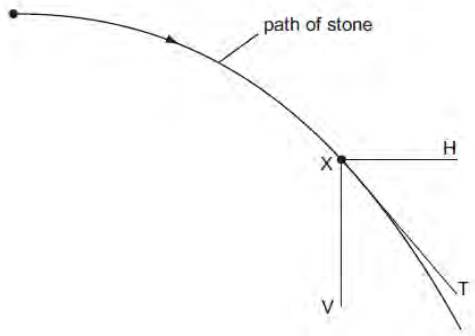
Which graph shows the variation with time of the speed of the car?



28. The diagram shows a velocity-time graph for a mass moving up and down on the end of a spring. Which point represents the velocity of the mass when at the lowest point of its motion?



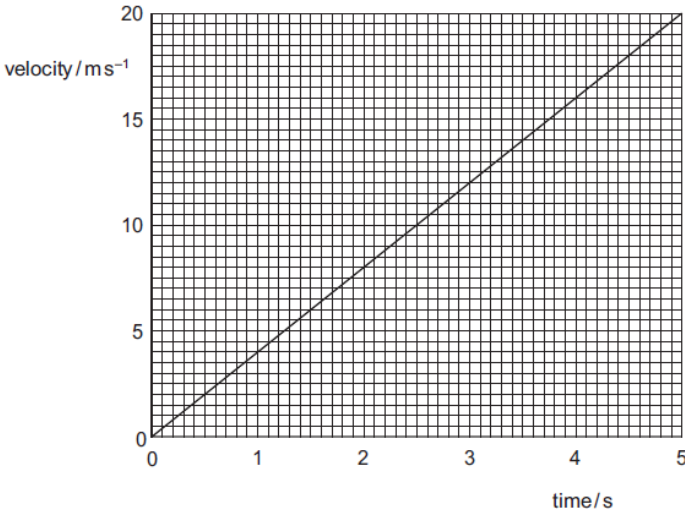
29. A stone is projected horizontally in a vacuum and moves along a path as shown. X is a point on this path. XV and XH are vertical and horizontal lines respectively through X. XT is the tangent to the path at X.



Along which direction or directions do forces act on the stone at X?
A XV B XH C XV and XH D XT

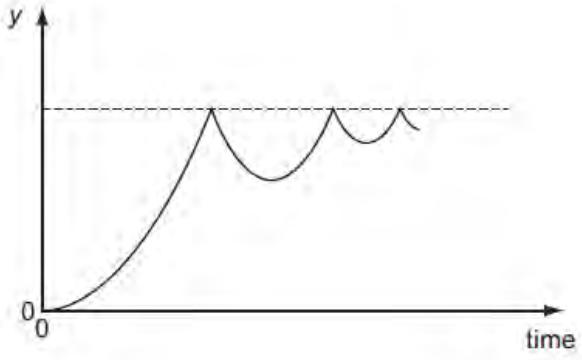
30. An experiment is done to measure the acceleration of free fall of a body from rest. Which measurements are needed?
A the height of fall and the time of fall
B the height of fall and the weight of the body
C the mass of the body and the height of fall
D the mass of the body and the time of fall

31. The velocity of an object during the first five seconds of its motion is shown on the graph.



What is the distance travelled by the object in this time?
A 4 m B 20 m C 50 m D 100 m

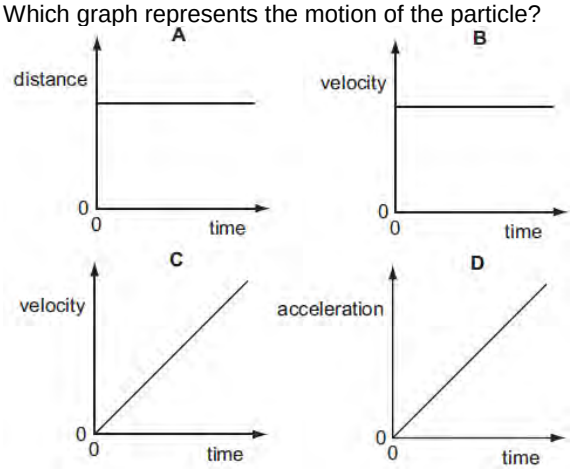
32. A ball is released from rest above a horizontal surface and bounces several times.
The graph shows how, for this ball, a quantity y varies with time.



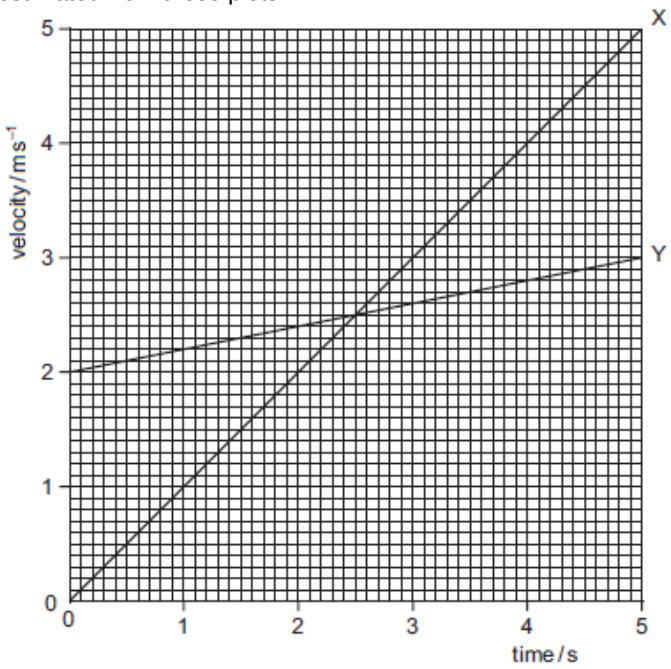
What is the quantity y?
A acceleration B displacement
C kinetic energy D velocity

33. A force F is applied to a freely moving object. At one instant of time, the object has velocity v and acceleration a.
Which quantities must be in the same direction?
A a and v only B a and F only C v and F only D v, F and a

34. A particle is moving in a straight line with uniform acceleration. Which graph represents the motion of the particle?



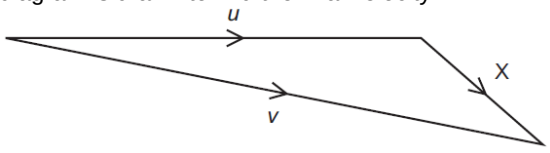
35. The graph shows velocity-time plots for two vehicles X and Y. The accelerations and distances traveled by the two vehicles can be estimated from these plots.



Which statement is correct?
A The accelerations of X and Y are the same at 2.5 s.
B The initial acceleration of Y is greater than that of X.
C The distance travelled by X is greater than that travelled by Y in the 5 s period.
D The distances travelled by X and Y in the 5 s period are the same.

36. On a particular railway, a train driver applies the brake of the train at a yellow signal, a distance of 1.0 km from a red signal, where it stops. The max. deceleration of the train is 0.2ms^{-2}. Assuming uniform deceleration, what is the maximum safe speed of the train at the yellow signal?
A 20 m s^{-1} B 40 m s^{-1} C 200 m s^{-1} D 400 m s^{-1}

37. An object has an initial velocity u. It is subjected to a constant force F for t seconds, causing a constant acceleration a. The force is not in the same direction as the initial velocity.
A vector diagram is drawn to find the final velocity v.

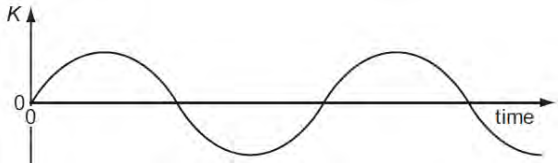


What is the length of side X of the vector diagram?
A F B F t C at D u + at

38. A stone is dropped from the top of a tower of height 40 m. The stone falls from rest and air resistance is negligible.
What time is taken for the stone to fall the last 10 m to the ground?
A 0.38 s B 1.4 s C 2.5 s D 2.9 s

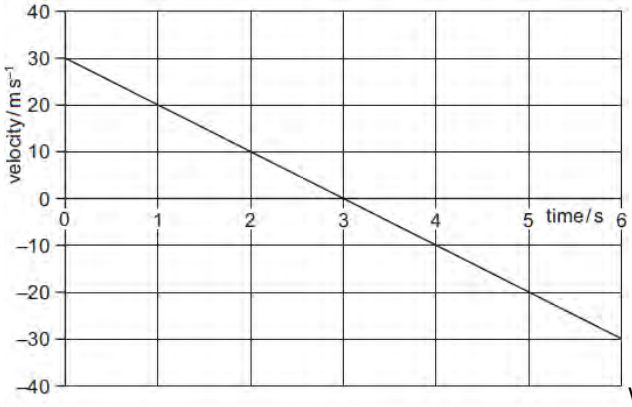
39. The symbol g represents the acceleration of free fall.
Which of these statements is correct?
A g is gravity. B g is reduced by air resistance.
C g is the ratio weight / mass. D g is the weight of an object.

40. A particle moves along a straight line. A particular property K of the particle's motion is plotted against time.



At any time, the slope of the graph is the acceleration of the particle. What is the property K?
A the displacement of the particle
B the distance travelled by the particle
C the speed of the particle
D the velocity of the particle

41. A stone is thrown vertically upwards. A student plots the variation with time of its velocity.

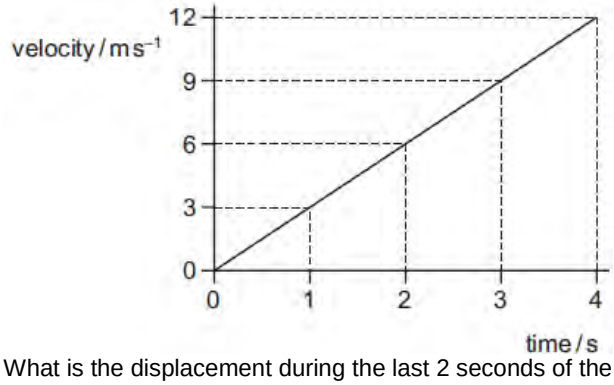


WWh at is the vertical displacement of the stone from its starting point after 5 seconds?
A 20 m B 25 m C 45 m D 65 m

42. An object accelerates in a direction that is always perpendicular to its motion. What is the effect, if any, of the acceleration on the object's speed and direction?

	speed	direction
A	changes	changes
B	changes	constant
C	constant	changes
D	constant	constant

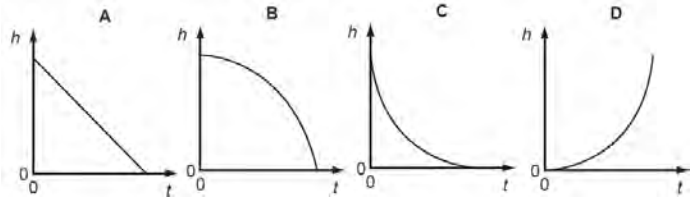
43. The diagram shows a velocity-time graph.



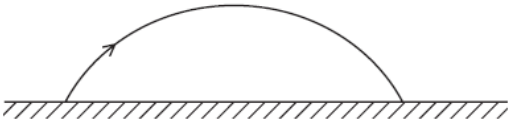
What is the displacement during the last 2 seconds of the motion?
A 6 m B 12 m C 18 m D 24 m

44. A supermarket trolley, total mass 30 kg, is moving at 3.0 m s^{-1}. A retarding force of 60 N is applied to the trolley for 0.50 s in the opposite direction to the trolley's initial velocity.
What is the trolley's new velocity after the application of the force?
A 1.0 m s^{-1} B 1.5 m s^{-1} C 2.0 m s^{-1} D 2.8 m s^{-1}

45. A small steel ball falls freely under gravity after being released from rest.
Which graph best represents the variation of the height h of the ball with time t ?



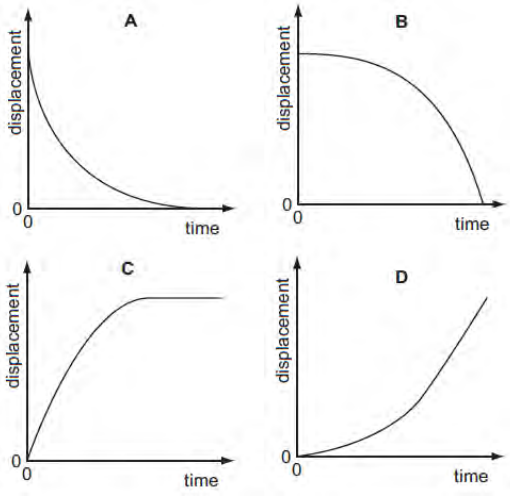
46. The diagram shows the path of a golf ball.



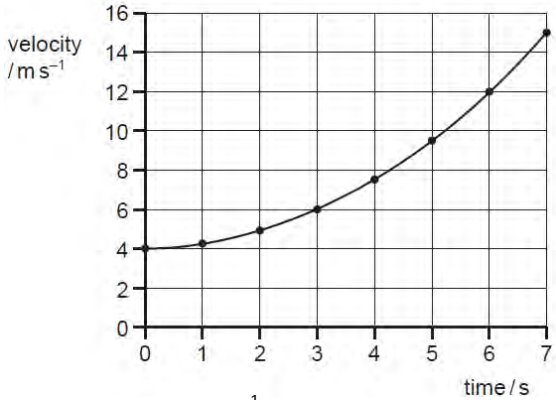
Which row describes changes in the horizontal and vertical components of the golf ball's velocity, when air resistance forces are ignored?

	horizontal	vertical
A	constant deceleration	constant acceleration downwards
B	constant deceleration	acceleration decreases upwards then increases downwards
C	constant velocity	constant acceleration downwards
D	constant velocity	acceleration decreases upwards then increases downwards

47. Which displacement-time graph best represents the motion of a falling sphere, the initial acceleration of which eventually reduces until it begins to travel at constant terminal velocity?



48. The diagram shows a velocity-time graph for a vehicle.



The vehicle, moving at 4.0 m s^{-1}, begins to accelerate at time = 0.
What is the vehicle's acceleration at time = 3.0 s?
A. 0.67 m s^{-2}. B. 1.0 m s^{-2}. C 1.3 m s^{-2}. D 2.0 m s^{-2}.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48		