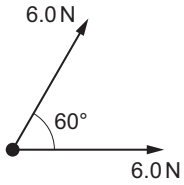
1 The table shows some physical quantities.

Which row correctly identifies the quantities as scalars or vectors?

	acceleration	charge	kinetic energy	wavelength
A	scalar	vector	vector	scalar
B	vector	vector	scalar	scalar
C	scalar	scalar	scalar	vector
D	vector	scalar	scalar	scalar

4 The diagram shows two forces of 6.0 N acting on an object. The angle between the lines of action of the two forces is 60°.



What is the magnitude of the resultant force?

A 6.0 N **B** 7.9 N **C** 10 N **D** 12 N

1 A child kicks a ball so that it leaves horizontal ground with a velocity of 28 m s^{-1} at an angle of 34° to the horizontal, as shown in Fig. 1.1.

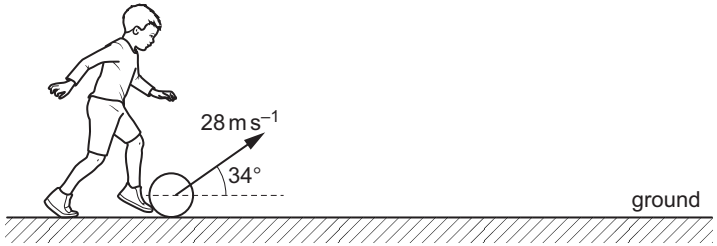


Fig. 1.1

Air resistance is negligible. The ball leaves the ground at time $t = 0$.

(a) (i) Calculate the horizontal component v_H and the vertical component v_V of the velocity of the ball immediately after it has left the ground.

v_H = ... m s^{-1}

v_V = ... m s^{-1} [2]

(ii) Show that the ball reaches its maximum height at time $t = 1.6$ s.

[1]

(iii) On Fig. 1.2, sketch the variation of v_H with time t between $t = 0$ and $t = 3.2\,s$. Label your line H.

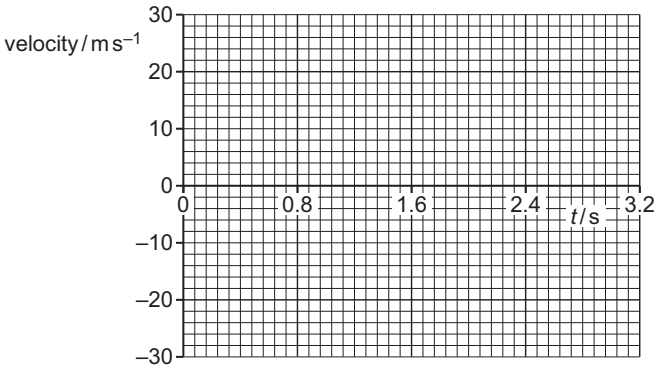


Fig. 1.2

[1]

(iv) On Fig. 1.2, sketch the variation of v_V with time t between $t = 0$ and $t = 3.2\,s$. Assume that velocity in the upward direction is positive. Label your line V. [3]

(b) The total change in momentum of the ball between leaving the ground at $t = 0$ and landing on the ground at $t = 3.2\,s$ is $13\,kg\,m\,s^{-1}$.

(i) Define momentum.

.....

..... [1]

(ii) Calculate the force that acts on the ball while it is in the air.

force = ... N [2]

(iii) Determine the mass of the ball.

mass = ... kg [1]

[Total: 11]

1 Which quantity is a vector?

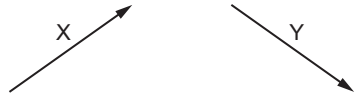
A pressure

B temperature

C weight

D work

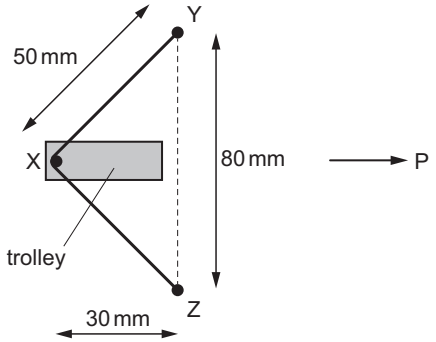
4 Two vectors, X and Y, are shown.



What are the directions of X + Y and X – Y?

	X + Y	X – Y
A	→	↓
B	→	↑
C	←	↓
D	←	↑

4 The diagram shows two fixed pins, Y and Z. A length of elastic is stretched between Y and Z and around pin X, which is attached to a trolley.



X is at the centre of the elastic and the trolley is to be propelled in the direction P at right angles to YZ. The tension in the elastic is 4.0 N.

What is the force accelerating the trolley in the direction P when the trolley is released?

A 2.4 N **B** 3.2 N **C** 4.8 N **D** 6.4 N

1 **(a)** Table 1.1 lists some physical quantities. Identify with ticks (✓) which quantities are vectors and which are scalars.

Table 1.1

quantity	scalar	vector
acceleration		
displacement		
gravitational potential energy		
speed		
temperature		

[2]

(b) A constant resultant force F acts on a car of mass m. The car moves from rest with constant acceleration a along horizontal ground. When the car has displacement s, the speed of the car is v.

(i) Using the concept of work done on the car, show that the kinetic energy E_K of the car is given by the equation

$$E_K = \frac{1}{2}mv^2.$$

[3]

(ii) The mass of the car is 920 kg. At time $t = 0$, the car is at rest. At time $t = 5.8$ s, its velocity is 17 m s^{-1}.

Calculate the kinetic energy of the car at time $t = 5.8$ s.

kinetic energy = ... J [1]

(iii) Between time $t = 0$ and time $t = 5.8\,s$, the work done against resistive forces is $4.7 \times 10^4\,J$.

Determine the average output power of the car during this time.

power = ... W [3]

(iv) At time $t = 5.8\,s$, the speed of the car becomes constant.

State and explain whether the output power of the car is greater than, less than or the same as the output power just before $t = 5.8\,s$.

.....

..... [1]

[Total: 10]