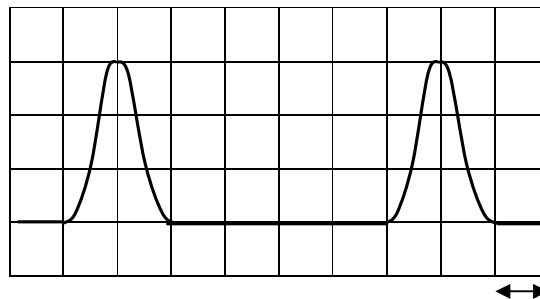


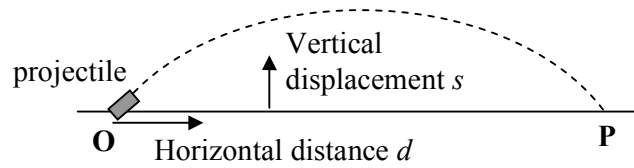
- 1 Which pair of the quantities below contains a scalar quantity and a vector quantity?
- A** resistance ; electric charge
B Young modulus ; strain
C pressure ; electric field strength
D wavelength ; frequency
- 2 A metal sphere of radius r is dropped into a tank of water. As it sinks at speed v , it experiences a drag force F and is given by the formula $F = kr v^2$, where k is a constant. What are the base units of k ?
- A** kg m^{-2}
B $\text{kg m}^2 \text{s}^{-1}$
C $\text{kg m}^{-1} \text{s}^{-1}$
D kg m s^{-2}
- 3 A boy throws an apple about 10 metres up into the air.
 What is the best estimate of the gravitational potential energy gained by the apple?
- A** 20 J **B** 200 J **C** 400 J **D** 600 J
- 4 A quantity P is calculated from measurements of X and Y using the formula $P = X Y$. The percentage uncertainties are: 0.3 % for X and 0.2 % for Y .
 Find the percentage uncertainty in the calculated value of P .
- A** 0.1 % **B** 0.5 % **C** 0.6 % **D** 0.8 %
- 5 The diagram shows two pulses on the screen of a cathode ray oscilloscope.
 A grid of 1 cm squares covers the screen. The time base setting is $10 \mu\text{s cm}^{-1}$.



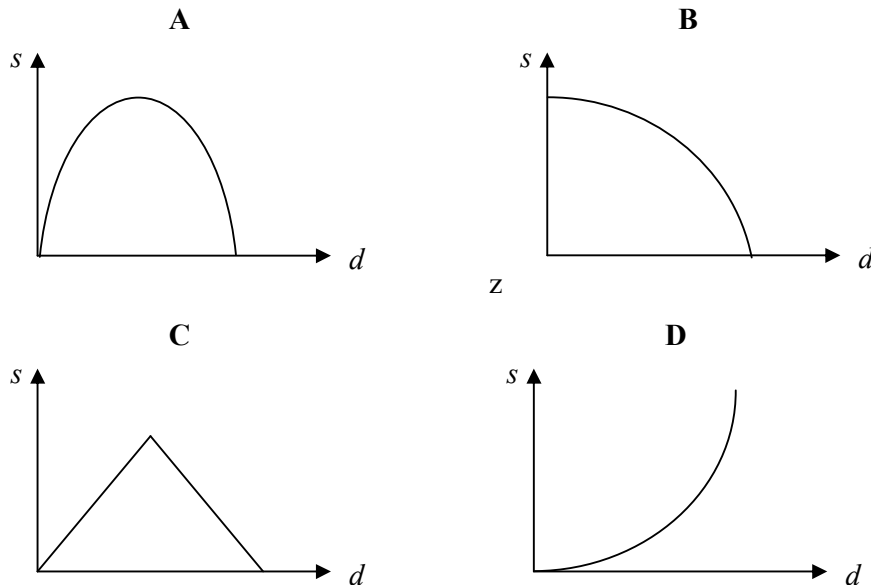
What is the time interval between the two pulses? 1 cm

- A** 20 μs **B** 40 μs **C** 60 μs **D** 80 μs
- 6 A car of 1000 kg speeds up uniformly from 10 ms^{-1} to 20 ms^{-1} in 5 seconds.
 What is the force needed to produce this motion?
- A** 2 kN **B** 4 kN **C** 6 kN **D** 10 kN

- 7 A projectile is launched upwards from point O at an angle to the horizontal as shown below.

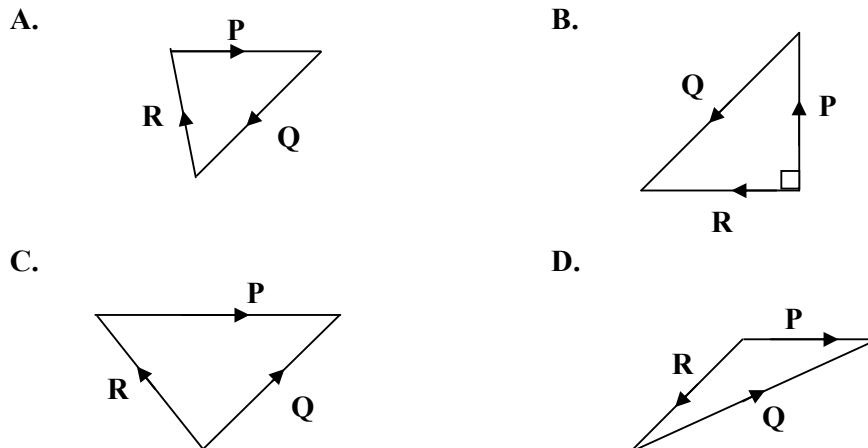


If the air resistance is negligible, which graph best represents the variation of vertical displacement s of the projectile with its horizontal distance d from point O to point P?



- 8 Three forces, namely P, Q and R, act on a moving trolley which continues to move at the same velocity.

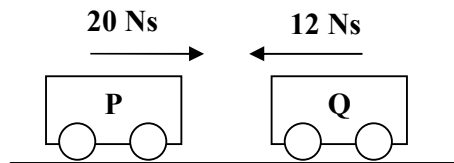
Which of the following vector diagrams shows the correct directions for the forces?



- 9 A ball is given an initial push to move up a ramp inclined at an angle to the horizontal. A graph of velocity versus time for the motion is given. Which of the following quantities **cannot** be determined from the graph?

A total distance traveled by the ball
 B time taken to reach the maximum displacement
 C acceleration of the ball up the slope
 D the maximum height of the ramp

- 10 The diagram shows two trolleys, P and Q, about to collide and gives the momentum of each trolley before the collision.



After the collision, the directions of the motion of both trolleys are reversed and the magnitude of the momentum of P is then 2 Ns.

What is the magnitude of the corresponding momentum of Q?

A 6 Ns B 10 Ns C 30 Ns D 34 Ns

- 11 The rate of change of momentum of a body falling freely under gravity is equal to its

A impulse.
 B kinetic energy.
 C power.
 D weight.

- 12 A meteorite from space falls towards the Earth.

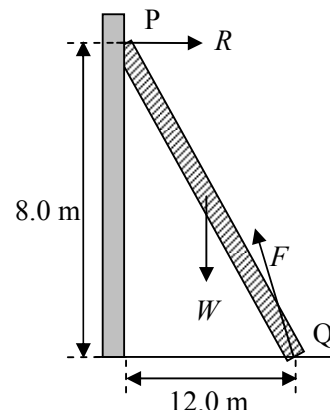
What happens to its kinetic energy and momentum during the course, assuming air resistance is negligible?

	Kinetic energy	momentum
A	increases	increases
B	increases	conserved
C	decreases	conserved
D	conserved	conserved

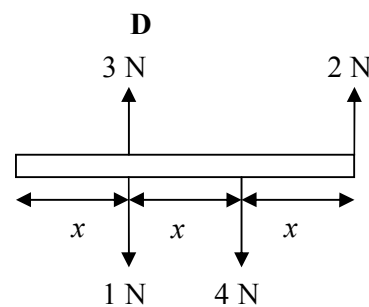
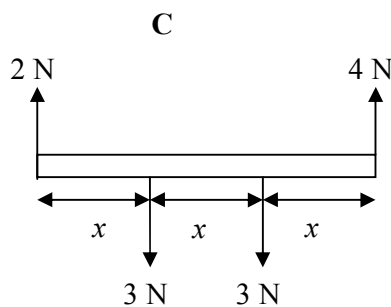
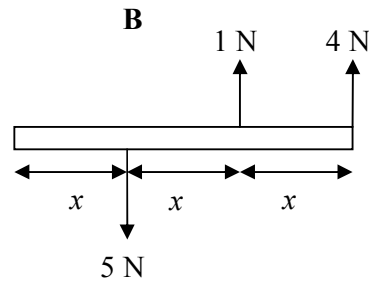
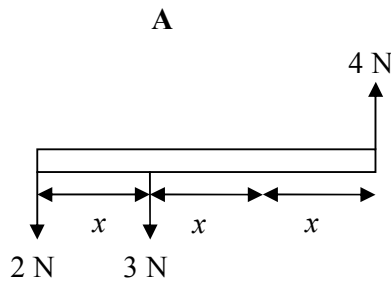
- 13 The figure shows a uniform ladder PQ leaning against a smooth, vertical wall. R is the normal reaction on the end P of the ladder and W the weight of the ladder.

What is the force F , in terms of W , acting on the end Q of the ladder by the ground?

A $0.67W$
 B $1.25W$
 C $1.50W$
 D $14.4W$

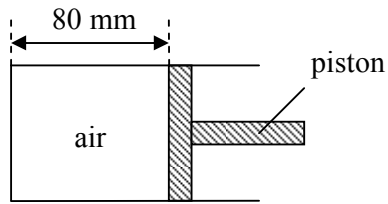


- 14** The force diagrams show all the forces acting on a beam of length of $3x$. Which force system causes no rotational motion of the beam and no linear movement?



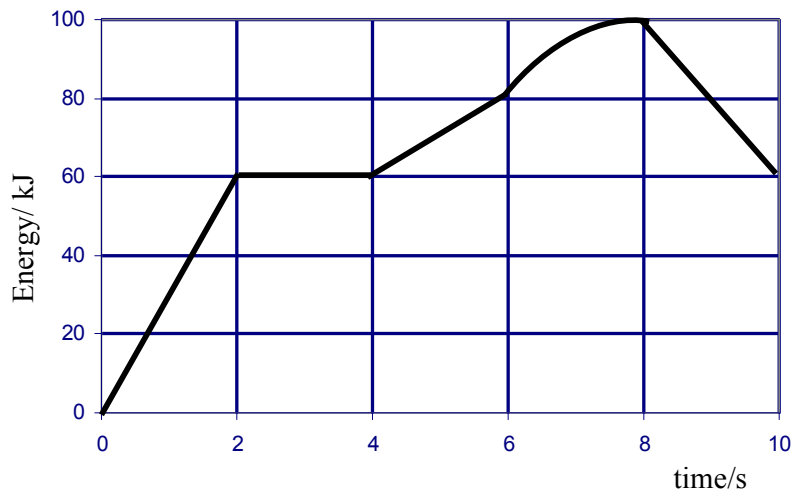
- 15** A steel ball is falling in oil at a constant speed. Which statement is correct?
- A** Since it is moving with a constant speed, no viscous force is acting on the ball.
 - B** Gravitational potential energy of the ball decreases at a constant rate.
 - C** The weight of the ball is balanced by upthrust produced by the displaced oil.
 - D** Internal energy of the oil remains unchanged.
- 16** The kinetic energy of mass m moving at a speed of v is given by $\frac{1}{2}mv^2$. Which equation, or principle of physics, is used in the derivation of this formula?
- A** force = mass \times acceleration
 - B** conservation of momentum
 - C** conservation of mass and energy
 - D** work done = force \times displacement
- 17** A crate is pushed 5 m along a horizontal surface by a force of 40 N. The frictional force opposing the motion is 15 N. How much of work done is to overcome the friction?
- A** 75 J
 - B** 125 J
 - C** 200 J
 - D** 325 J

- 18** Air is enclosed in a cylinder by a gas-tight, frictionless piston of cross-sectional area $3.0 \times 10^{-3} \text{ m}^2$. Initially, the piston settles 80 mm from the end of the cylinder as shown in the diagram below.



Work done by the air when it expands at atmospheric pressure, i.e. at 100 kPa, is 36 J. What is the new position from the end of the cylinder right after the expansion?

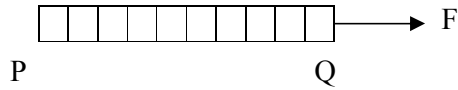
- A** 40 mm **B** 120 mm **C** 200 mm **D** 375 mm
- 19** The total electrical energy generated from a generator during the first 10 seconds is shown in the graph.




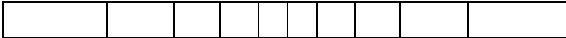

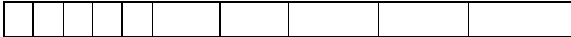
What is the maximum electrical power generated at any instant during these first 10 seconds?

- A** 10 kW **B** 20 kW **C** 30 kW **D** 67 kW
- 20** The inference made from Brownian motion is that
- A** gas molecules exist and move about randomly at high speeds.
 - B** smoke particles can be used as models of air molecules.
 - C** smoke particles and air molecules move about randomly.
 - D** gas molecules exist and can be seen as bright dots moving about randomly.

- 21 A uniform strip of rubber, marked with equal divisions, is fixed at end P and pulled into tension by a force F at the end Q as shown.



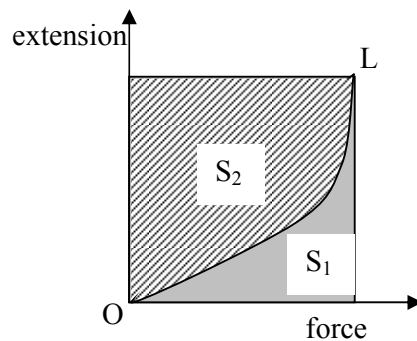
Which diagram shows the separation of the divisions when the elastic is extended to twice its original length?

- A 
- B 
- C 
- D 

- 22 What is the *Young modulus* of a material?

- A strain / stress
 B force / cross-sectional area
 C (force \times cross-sectional area) / (extension \times original length)
 D (force \times original length) / (extension \times cross-sectional area)

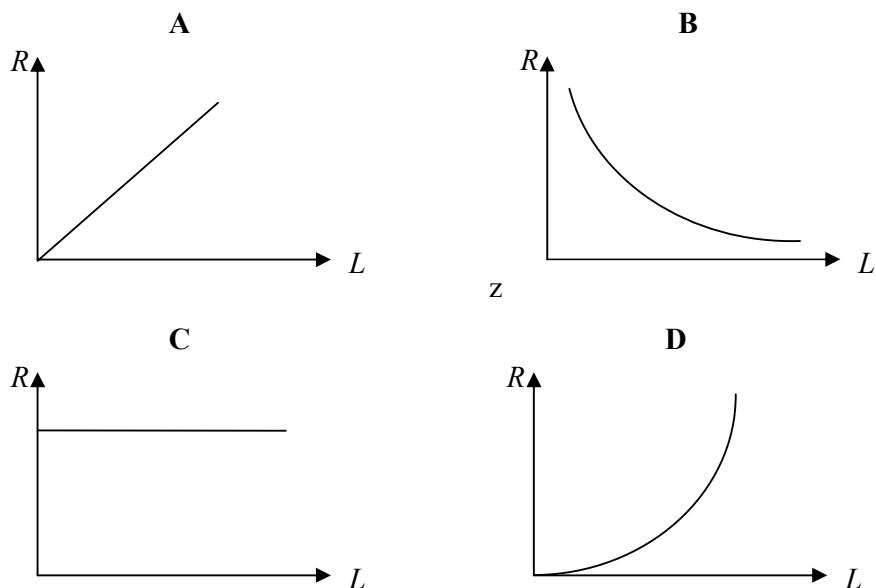
- 23 The figure shows the relation between the force applied and the extension for a wire.



If the shaded areas are S_1 and S_2 , the elastic energy stored by the wire when strained from O to L is

- A S_1
 B S_2
 C $S_2 - S_1$
 D $\frac{1}{2} (S_2 + S_1)$

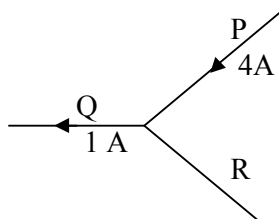
- 24** Different lengths of copper wires of uniform cross-sectional area are cut from a coil. Which graph shows correctly the variation of resistance R of these wires with their length L ?



- 25** What is the working resistance of a light bulb with a power rating P at the operating voltage V ?

A P/V **B** $(P/V)^2$ **C** V/P^2 **D** V^2/P

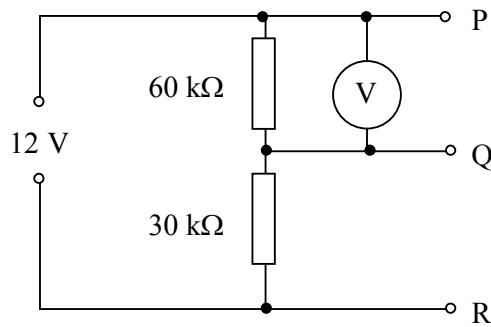
- 26** The diagram below shows a junction in a circuit where three wires P, Q and R meet.



How many coulombs of charge pass a given point in wire R in 2 seconds?

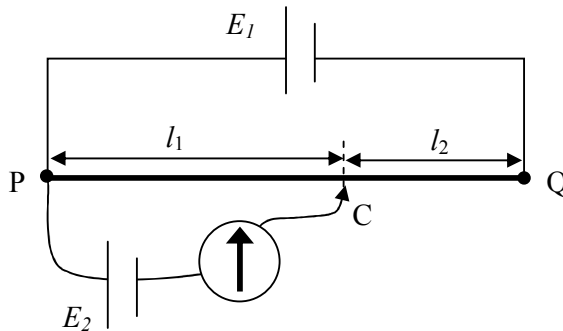
A 6 **B** 8 **C** 10 **D** 15

- 27 The diagram shows a 12 V supply of negligible internal resistance connected to two resistors with a voltmeter of resistance $60\text{ k}\Omega$ connected between P and Q.



The potential difference, in V, between Q and R is

- A 4.8 B 6.0 C 7.2 D 9.0
- 28 Two cells of e.m.f.'s E_1 and E_2 and of negligible internal resistance are connected to a wire of length l . The wire is fixed at point P and point Q as shown in the diagram below. C is the contact point of jockey on the wire.

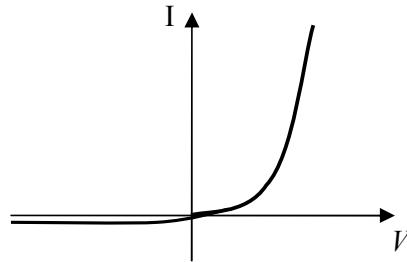


When the galvanometer shows no deflection, the length of wire between PC and CQ are measured as l_1 and l_2 , respectively.

What is the value of the ratio E_2 / E_1 ?

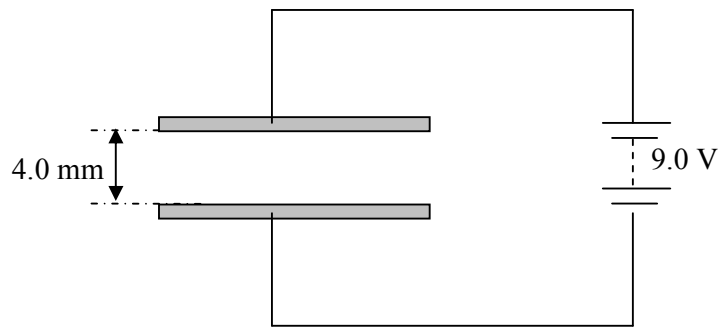
- A $\frac{l_1}{l_2}$ B $\frac{l_1}{l}$ C $\frac{l_2}{l}$ D $\frac{l_2}{l_1 + l_2}$

- 29 A certain electrical component Z has the current-voltage characteristics as shown below.



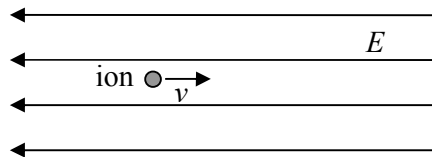
Identify Z.

- A thermistor
 - B filament of a lamp
 - C semiconductor diode
 - D carbon resistor
- 30 The diagram shows a pair of metal plates 4.0 mm apart connected to a 9.0 V battery.



What is the electric field strength between the plates?

- A $2.3 \times 10^3 \text{ NC}^{-1}$
 - B 36 NC^{-1}
 - C $3.6 \times 10^{-2} \text{ NC}^{-1}$
 - D $4.4 \times 10^{-4} \text{ NC}^{-1}$
- 31 A positive ion is projected with an initial velocity v into a uniform electric field E , as shown below.

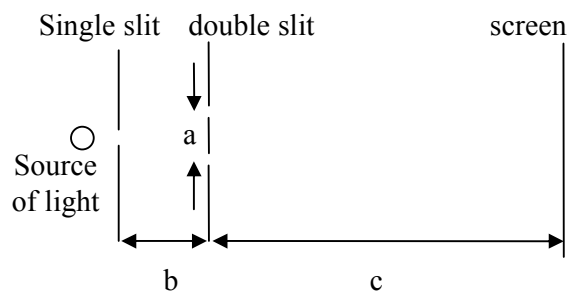


Which of the following statements correctly describes the subsequent motion of the ion?

- A Velocity of ion is increasing.
- B Velocity of ion is decreasing.
- C Velocity of ion is constant.
- D Ion is deflected.

- 32 A progressive simple harmonic wave has a frequency of 300 Hz and a velocity of 30 ms^{-1} . Its wavelength is
- A 0.10 m.
B 1.00 m.
C 10.00 m.
D 9000 m.
- 33 A sound wave is set up in a long tube, closed at one end. The length of the tube is adjusted until the sound from the tube is the loudest.
What is the nature of the sound in the tube?
- A longitudinal and progressive
B longitudinal and stationary
C transverse and progressive
D transverse and stationary
- 34 A technician is measuring the intensity of a sound. Near a loudspeaker his meter records an intensity I . This corresponds to an amplitude A of the sound wave. He decreases the amplitude of the sound to $\frac{1}{2} A$.
What reading would this meter give at the same position?
- A. $\frac{I}{\sqrt{2}}$ B. $\frac{I}{2\sqrt{2}}$ C. $\frac{I}{4}$ D. $\frac{I}{2}$
- 35 Physical properties shared by both radio waves and sound waves are
1. both can be polarised
 2. both are electromagnetic waves
 3. both can be diffracted
- A if all correct
B if 1 and 2 correct
C if 2 and 3 correct
D if only 3 is correct
- 36 Monochromatic light of wavelength $6 \times 10^{-7} \text{ m}$ falls normally on a grating with 500 lines per mm. Up to what order of spectrum can this grating produce?
- A 2
B 3
C 4
D 5

- 37 A teacher sets up the apparatus shown to demonstrate a two-slit interference pattern on the screen.



Which change to the apparatus will increase the fringe spacing?

- A increasing the distance b
 - B increasing the distance a
 - C decreasing the distance c
 - D decreasing the frequency of the light
- 38 From observations made in Rutherford's experiments to investigate the nature of the atom, the following statements are valid deductions about the atom except
- A the atom is mostly empty space.
 - B the nucleus is positively charged.
 - C the nucleus consists of the protons and neutrons.
 - D the atomic diameter is very much larger than the nuclear diameter.
- 39 A certain radioactive nuclide of nucleon number m_x , disintegrates, with the emission of a beta-particle and gamma radiation only, to give a second nuclide of a nucleon number m_y . Which one of the following equation correctly relates m_x and m_y ?
- A $m_y = m_x$
 - B $m_y = m_x - 1$
 - C $m_y = m_x + 1$
 - D $m_y = m_x + 2$
- 40 Which is the most correct statement concerning radiation from radioactive materials?
- A Alpha-particles have positive charge.
 - B Gamma rays are not deflected by a magnetic field unless the field is very strong
 - C Beta-particles can penetrate 1 cm of lead.
 - D Alpha-particles and beta-particles are always emitted together.