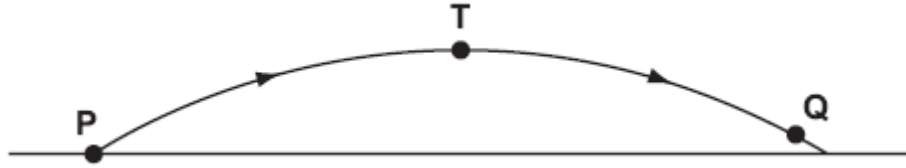
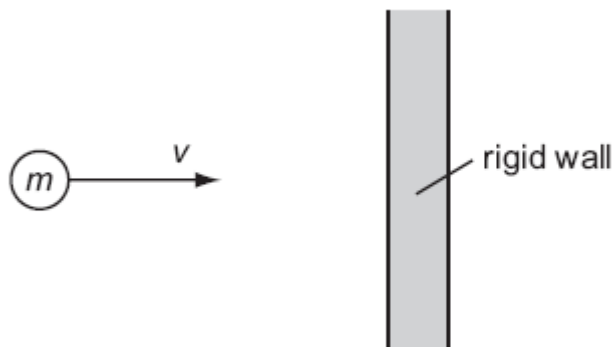


- 1** Which of the following is a scalar quantity?
- A** acceleration  
**B** energy  
**C** momentum  
**D** velocity
- 2** The unit of work, the joule, may be defined as the work done when the point of application of a force of 1 newton is moved a distance of 1 metre in the direction of the force. Express the joule in terms of the base units of mass, length and time, the kg, m and s.
- A**  $\text{kg s}^{-2}$       **B**  $\text{kg m}^2 \text{s}^{-2}$       **C**  $\text{kg m}^2 \text{s}^{-1}$       **D**  $\text{kg m}^{-1} \text{s}^2$
- 3** The momentum of an object of mass  $m$  is  $p$ . Which quantity has the same base units as  $\frac{p^2}{m}$  ?
- A** energy  
**B** force  
**C** power  
**D** velocity
- 4** A thermometer can be read to an accuracy of  $\pm 0.5^\circ\text{C}$ . This thermometer is used to measure a temperature rise from  $40^\circ\text{C}$  to  $100^\circ\text{C}$ .  
What is the percentage uncertainty in the measurement of the temperature rise?
- A** 0.5 %      **B** 0.8 %      **C** 1.3 %      **D** 1.7%
- 5** 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 horizontal component of velocity of the stone is

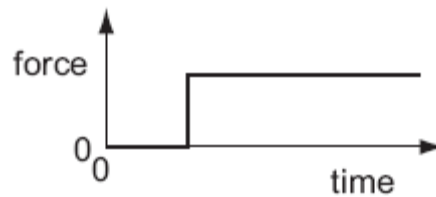
- A zero at T.
  - B greatest at T.
  - C greatest at Q.
  - D the same at Q as at T.
- 6 A constant mass undergoes uniform velocity.  
Which of the following is a correct statement about the resultant force acting on the mass?
- A It increases uniformly with respect to time.
  - B It is constant but not zero.
  - C It is proportional to the displacement from a fixed point.
  - D It is zero.
- 7 A particle of mass  $m$  strikes a vertical rigid wall perpendicularly from the left with velocity  $v$ .



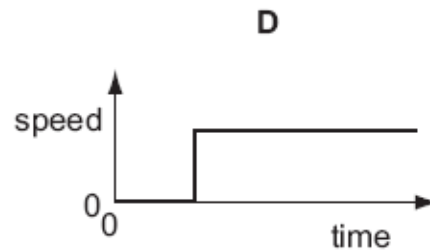
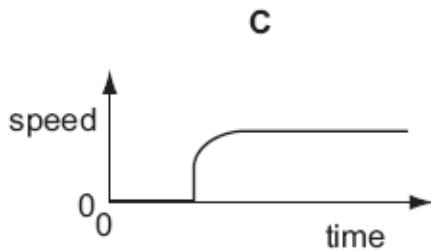
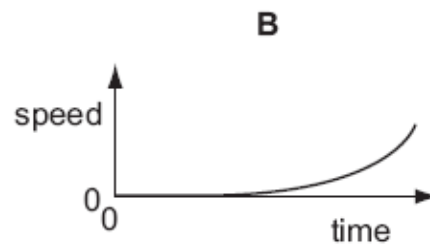
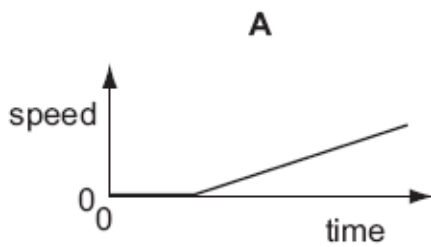
If the collision is perfectly elastic, the total change in momentum of the particle that occurs as a result of the collision is

- |                       |                      |
|-----------------------|----------------------|
| A $2mv$ to the right. | C $mv$ to the right. |
| B $mv$ to the left.   | D $2mv$ to the left. |

- 8** 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?



- 9** Which is a statement of the principle of conservation of momentum?
- A** A force is equal to the rate of change of momentum of the body upon which it acts.
  - B** The total momentum of a system of interacting bodies remains constant, providing no external force acts.
  - C** The momentum of a body is the product of the mass of the body and its velocity.
  - D** In a perfectly elastic collision, the relative momentum of the bodies before impact is equal to their relative momentum after impact.

**10** Which is not one of Newton's laws of motion?

- A** The total momentum of a system of interacting bodies remains constant, providing no external force acts.
- B** The rate of change of momentum of a body is directly proportional to the external force acting on the body and takes place in the direction of the force.
- C** If body A exerts a force on body B, then body B exerts an equal and oppositely-directed force on body A.
- D** A body continues in a state of rest or of uniform motion in a straight line unless acted upon by some external force.

**11** Two equal masses travel towards each other on a frictionless air track at speeds of  $60 \text{ cm s}^{-1}$  and  $40 \text{ cm s}^{-1}$ . They stick together on impact.



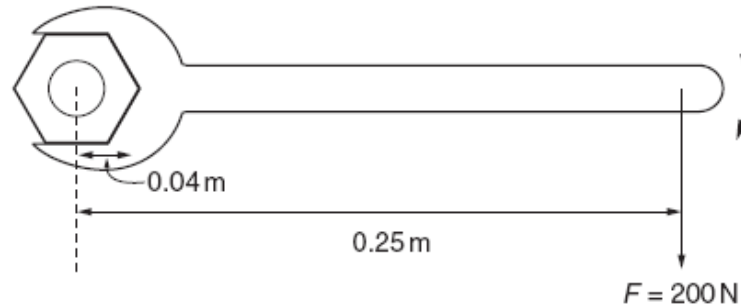
What is the speed of the masses after impact?

- A**  $10 \text{ cm s}^{-1}$    **B**  $20 \text{ cm s}^{-1}$    **C**  $40 \text{ cm s}^{-1}$    **D**  $50 \text{ cm s}^{-1}$

**12** What is the centre of gravity of an object?

- A** the geometrical centre of the object
- B** the point about which the total torque is zero
- C** the point at which the weight of the object may be considered to act
- D** the point through which gravity acts

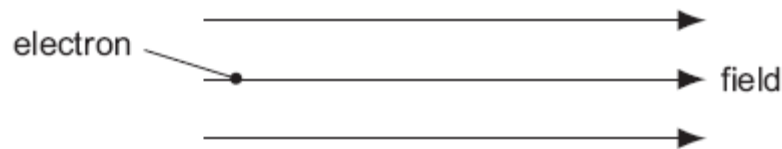
**13** A spanner is used to tighten a nut as shown. A force  $F$  is applied at right-angles to the spanner at a distance of  $0.25 \text{ m}$  from the centre of the nut. When the nut is fully tightened, the applied force is  $200 \text{ N}$ .



What is the resistive torque, in an anticlockwise direction, preventing further tightening?

- A 8Nm                                      C 50Nm  
B 25Nm                                      D 800Nm

- 14 An electron is situated in a uniform electric field, as shown in the diagram.



What is the direction of the changes of momentum experience by the electron?

- A downwards                                      C to the right  
B to the left                                      D upwards

- 15 The speed of a particle is increased by a factor of 4. By what factor does its kinetic energy increase?

- A 2                      B 4                      C 8                      D 16

- 16 A horizontal force of 90 N is used to push a box across a horizontal floor. The frictional force on the box is 50 N.

What is the heat energy dissipated when it is moved through a distance of 6.0 m?

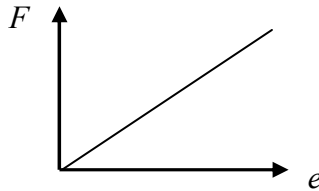
- A 240 J                      B 300 J                      C 540 J                      D 840 J

- 17 The density of mercury is  $13.6 \text{ kgm}^{-3}$ . The pressure difference between the bottom and the top of a column of mercury is 100 kPa.

What is the height of the column?

- A 7.4m      B 1.3m      C 0.75m      D 72m

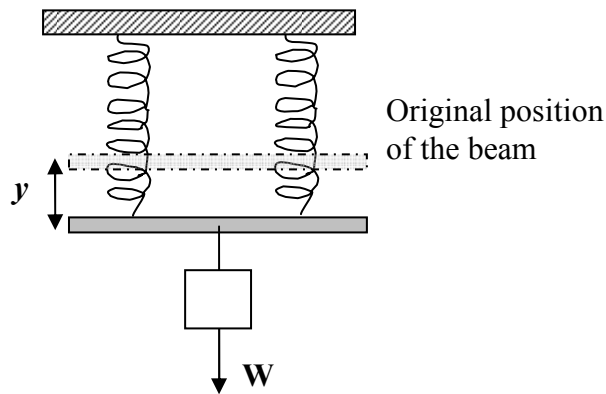
- 18 Which expression defines power?
- A force  $\times$  distance moved in the direction of the force
- B force  $\times$  velocity
- C Work done  $\times$  time taken
- D Work done  $\div$  time taken
- 19 Which statement applies to the boiling but not to the evaporation of a liquid?
- A The separation of the molecules increases greatly
- B At normal atmospheric pressure, the process occurs at one temperature only.
- C Energy must be provided for the process to happen.
- D All the bonds between molecules in the liquid are broken.
- 20 Which two substances are normally both crystalline?
- A diamond and rubber
- B copper and glass
- C diamond and glass
- D copper and diamond
- 21 Figure below shows how the extension  $e$  of a wire varies with the force  $F$  applied. If the original length of the wire is  $l$ , its cross-sectional area  $A$  and its Young modulus is  $E$ , the gradient of the graph is



- A  $\frac{El}{A}$
- B  $\frac{EA^2}{l}$
- C  $El^2 A$
- D  $\frac{EA}{l}$

- 22 What is the Young modulus of a material?
- A. (force  $\times$  original length) / (extension  $\times$  cross-sectional area)
- B. (force  $\times$  cross-sectional area) / (extension  $\times$  original length)
- C. strain / stress
- D. force / cross-sectional area

- 23** A beam, the weight of which may be neglected, is supported by two identical springs. When a weight  $W$  is hung from the middle, the extension of each spring is  $y$ .



Another identical spring is then hung in between the two springs.

What is the extension when a weight of  $2W$  is hung from the middle of the beam?

- A.  $\frac{1}{2}y$
- B.  $\frac{3}{2}y$
- C.  $\frac{2}{3}y$
- D.  $\frac{4}{3}y$
- 24** Which of the following lists three regions of the electromagnetic spectrum in order of increasing frequency?
- A gamma-rays, ultraviolet, radio waves
- B gamma-rays, visible radiation, ultraviolet
- C microwaves, ultraviolet, X-rays
- D radio waves, visible radiation, infra-red
- 25** Progressive waves of frequency 300 Hz are superimposed to produce a system of stationary waves in which adjacent nodes are 1.5 m apart. What is the speed of the progressive waves?
- A.  $200 \text{ ms}^{-1}$     B.  $450 \text{ ms}^{-1}$     C.  $900 \text{ ms}^{-1}$     D.  $1800 \text{ ms}^{-1}$
- 26** Which effect provides direct experimental evidence that light is a transverse, rather than a longitudinal, wave motion?
- A Light can be diffraction.
- B Two coherent light waves can be made to interfere.
- C Light can be polarised.
- D The intensity of light obeys the inverse square law.

- 27 A narrow beam of monochromatic light falls at normal incidence on a diffraction grating. Third-order diffraction beams are formed at angles of  $45^\circ$  to the original direction. What is the highest order of diffracted beam produced by this grating?

A 3<sup>rd</sup>                      B 4<sup>th</sup>                      C 5<sup>th</sup>                      D 6<sup>th</sup>

- 28 Which one of the following pairs correctly describes the amplitude of displacement and pressure change at a displacement node in a stationary sound wave?

	displacement amplitude	pressure change
A	zero	maximum
B	maximum	minimum
C	maximum	maximum
D	zero	minimum

- 29 A sound wave of frequency 400 Hz is travelling in air at a speed of  $320 \text{ ms}^{-1}$ . What is the difference in phase between two points on the wave 0.2 m apart in the direction of travel in rad?

A  $\pi/4$                       B  $\pi/2$                       C  $2\pi/5$                       D  $4\pi/5$

- 30 The current in a component is increased uniformly from 20mA to 80 mA over a time period of 4.0 s. What is the charge that flows during this time?

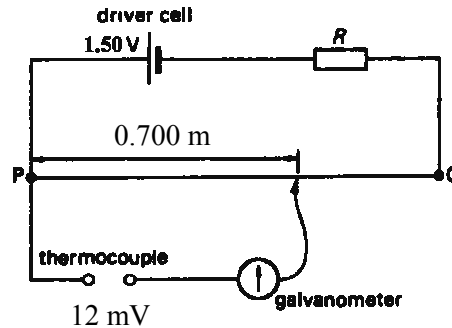
A 240 mC                      B 200 mC                      C 120 mC                      D 60 mC

- 31 The electric field strength between a pair of parallel plates is E. The separation of the plates is doubled and the potential difference between the plates is increased by a factor of four. What is the new electric field strength?

A E                      B 2E                      C 4E                      D 5E



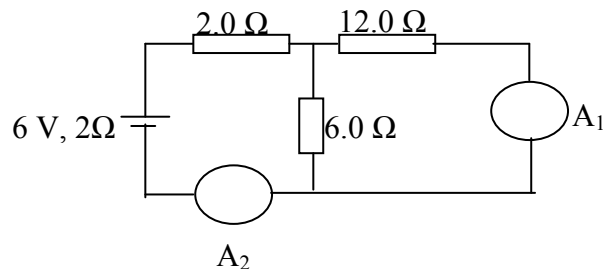
- 32 The diagram below shows a simple potentiometer circuit for measuring a small e.m.f. produced by a thermocouple.



- The meter wire  $PQ$  has a resistance of  $10\ \Omega$  and the driver cell has an e.m.f. of 1.50 V. If a balance point is obtained 0.700 m along  $PQ$  when measuring an e.m.f. of 12.00 mV, what is the value of the resistance  $R$ ?
- A 445  $\Omega$       B 867  $\Omega$       C 882  $\Omega$       D 1240  $\Omega$
- 33 An electron, travelling horizontally at constant speed in a vacuum, enters a vertical downward electric field between two charged parallel plates. What are the horizontal and vertical components of the motion of this electron when it is in the field?

	Horizontal component of motion	Vertical component of motion
A	constant speed	acceleration upwards
B	constant speed	acceleration downwards
C	acceleration to the right	acceleration downwards
D	acceleration to the right	acceleration upwards

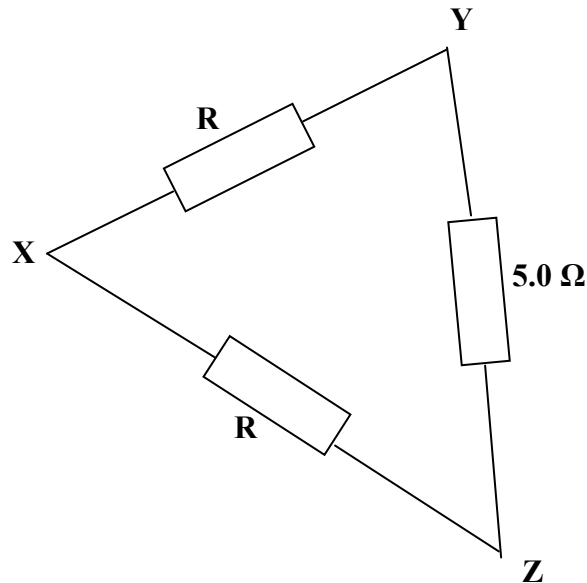
34



What is the ratio of the reading of ammeter  $A_1$  to reading of ammeter  $A_2$  for the circuit above?

- A 1 : 3      B 1 : 2      C 3 : 1      D 6 : 11

- 35** The figure below shows a network of three resistors. Two of these, marked  $R$ , are identical. The other one has a resistance of  $5.0\ \Omega$ .



- The resistance between Y and Z is found to be  $2.5\ \Omega$ . What is the resistance between X and Y?
- A**  $0.21\ \Omega$       **B**  $0.53\ \Omega$       **C**  $1.90\ \Omega$       **D**  $4.8\ \Omega$
- 36** A generator produces  $50\ \text{kW}$  of power at a potential difference of  $10\ \text{kV}$ . The power is transmitted through cables of total length of  $3\ \text{km}$ . If the mean resistance of the cable is  $5\ \Omega$  per kilometer, what is the total power lost in the cables?
- A**  $25\ \text{W}$       **B**  $50\ \text{W}$       **C**  $375\ \text{W}$       **D**  $3750\ \text{W}$
- 37** What is a correct statement of Ohm's law?
- A** The potential differences across a component equals the current providing the resistance and other physical conditionals stay constant.
- B** The potential difference across a component equals the current multiplied by the resistance.
- C** The potential difference across a component is proportional to its resistance.
- D** The potential difference across a component is proportional to the current in it providing physical conditionals stay constant.

- 38 A radioactive decay is said to be random because
- A it is unaffected by temperature.
  - B it is affected by the chemical combination.
  - C the particles are not emitted at equal intervals of time.
  - D a lot of heat is produced.
- 39 A radioactive isotope of cobalt  ${}^{60}_{27}\text{Co}$  decays by emission of a beta particle followed by emission of one or more gamma photons. The proton number for the product nuclide is
- A 29                      B 28                      C 27                      D 26
- 40 Which of the following statements about  $\alpha$ -particle is **not** correct?
- A They produce fluorescence in substance like zinc sulphide and barium platinocyanide.
  - B They can be deflected by both magnetic and electric field.
  - C They can travel distances of the order of metres in air under ordinary conditions.
  - D They produce intense ionization in the gases through which they pass.