1 Which **one** of the following quantities is a vector?

A Work
B Temperature
C Electric field
D Pressure

2 The period T of oscillation of a mass m attached to the end of a spring is given by $T = 2\pi\sqrt{m/k}$ where k is an accurately known constant. The mass is measured as 0.500 ± 0.045 kg. What is the percentage uncertainty in the calculated value of the period?

A 3.0 %
B 4.5 %
C 9.0 %
D 18 %

3 In an experiment to determine the acceleration of free fall, g, a lump of plasticine is released at height, h of 180.0 ± 0.1 cm. Time taken for the plasticine to fall through this height, t, is measured to be 0.6 ± 0.1 sec. Find the experimental acceleration with its absolute uncertainty.

A $(10.0 \pm 0.3)\ ms^{-2}$
B $(10 \pm 3.3)\ ms^{-2}$
C $(10 \pm 3)\ ms^{-2}$
D $(10.0 \pm 3.0)\ ms^{-2}$

4 An animal of mass 40 kg changes its velocity from 5.5 ms^{-1} due north to 10 ms^{-1} due west in 0.5 seconds to escape from a predator. What is the magnitude of the resultant force used by the animal?

A 22.4 N
B 360 N
C 914 N
D 1240 N

5 The resistive force F acting on a sphere of radius r moving at speed v through a liquid is given by $F = cvr$ where c is a constant. Which of the following is a correct unit for c?

A N **B** Ns^{-1} **C** $Nm^2\ s^{-1}$ **D** $Nm^{-2}\ s$

6 Three forces of magnitude $F_1 = 3.0$ N, $F_2 = 4.0$ N and $F_3 = 6.0$ N act at a point. The point is in equilibrium. The magnitude of the resultant of F_1 and F_2 is

A 1.0 N. **B** 5.0 N. **C** 6.0 N. **D** 7.0 N.

7 What is the condition for an object to be in translational equilibrium?

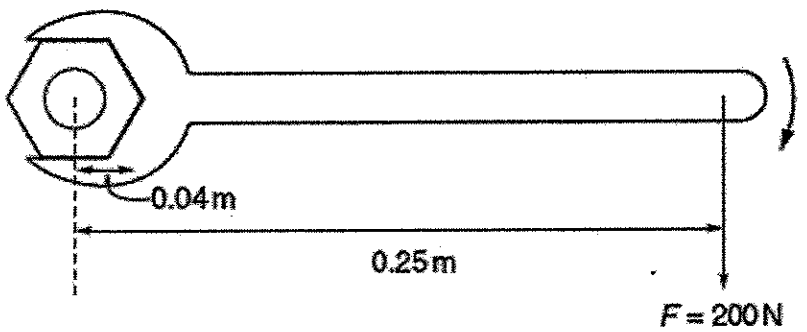
A The forces acting upwards are equal to the forces acting downwards.

B The object must be at rest.

C The object must be moving at constant speed.

D There is no resultant force on the object in any direction.

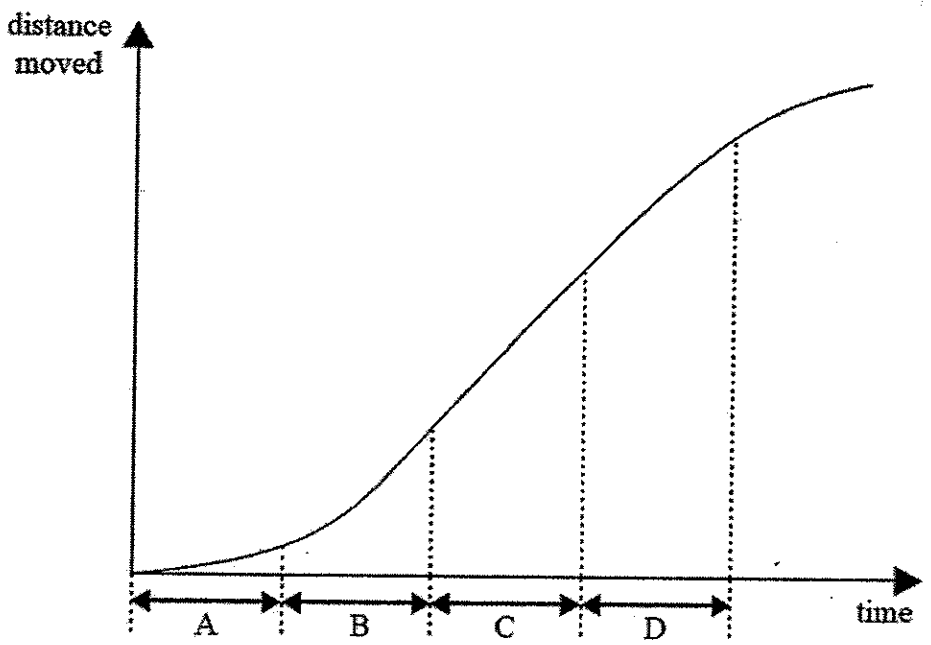
8 Spanner is used to tighten a nut as shown. A force F is applied at right-angles to the spanner at a distance of 0.25 m from the centre of the nut. When the nut is fully tightened, the applied force is 200 N.



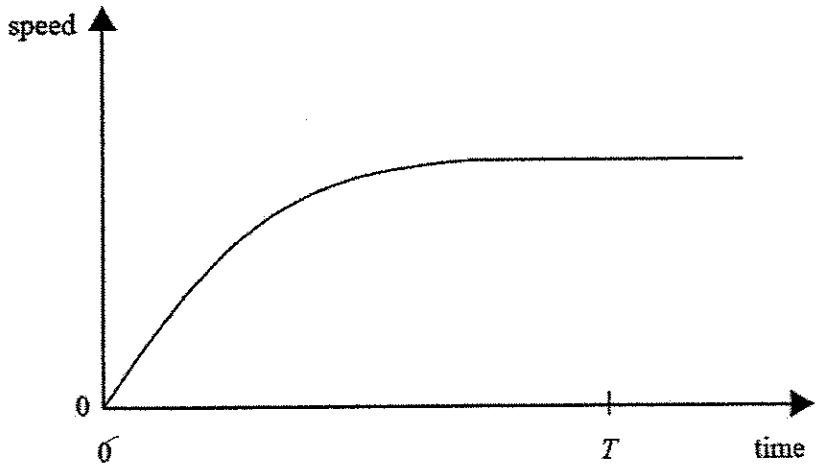
What is the resistive torque, in an anticlockwise direction, preventing further tightening?

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

9 The graph below shows the variation with time of the distance moved by a car along a straight road. During which time interval does the car have its greatest acceleration?



10 The variation with time of the vertical speed of a ball falling in air is shown below. During the time from 0 to T, the ball gains kinetic energy and loses gravitational potential energy ΔEp . Which of the following statements is true?



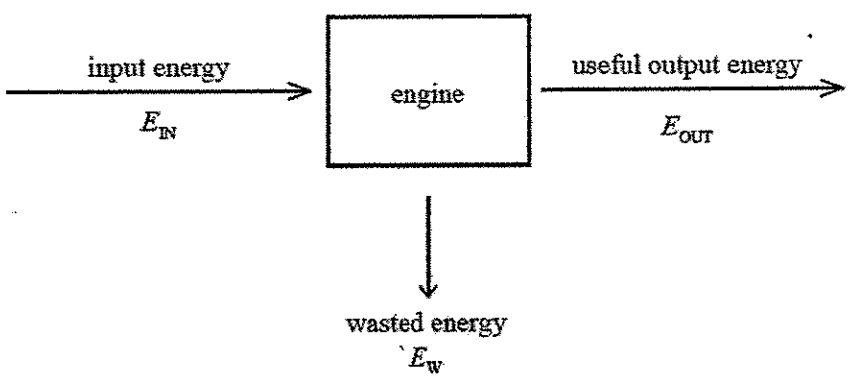
A ΔEp is equal to the gain in kinetic energy.

B ΔEp is greater than the gain in kinetic energy.

C ΔEp is equal to the work done against air resistance.

D ΔEp is less than the work done against air resistance.

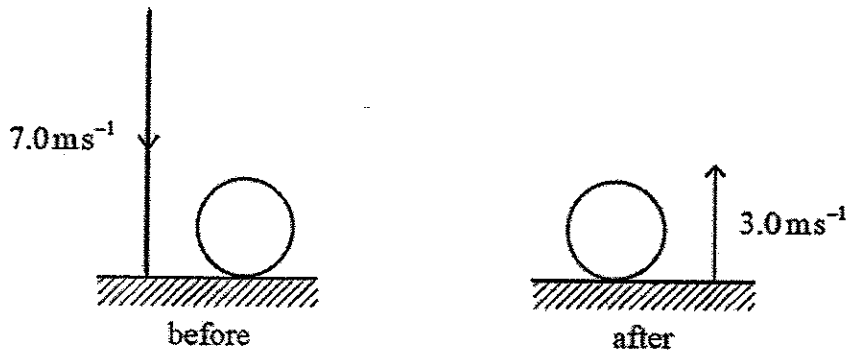
11 The diagram below represents energy transfers in an engine.



The efficiency of the engine is given by the expression

A E_W / E_{IN} **B** E_W / E_{OUT} **C** E_{OUT} / E_{IN} **D** E_{OUT} / E_W

12 A ball of mass 2.0 kg falls vertically and hits the ground with speed 7.0 ms^{-1} as shown below.



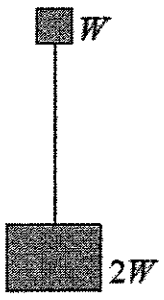
The ball leaves the ground with a vertical speed 3.0 ms^{-1} .The magnitude of the change in momentum of the ball is

A zero. **B** 8.0 N s. **C** 10 N s. **D** 20 N s.

13 Two blocks having different masses slide down a frictionless slope. Which of the following correctly compares the accelerating force acting on each block and also the accelerations of the blocks down the slope?

	Accelerating force	Acceleration
A	Equal	Equal
B	Equal	Different
C	Different	Equal
D	Different	Different

14 A body of weight $2W$ hangs vertically from a string attached to a body of weight W. Weight W is released and both bodies fall vertically.



Air resistance may be neglected. What is the tension in the string during the fall?

A Zero **B** W **C** $2W$ **D** $3W$

15 The inertial mass of an object defines the property that

A is the product of resultant force acting on the object and the duration of the time applied.

B keeps the object moving when no force acts on it.

C gives a measure of the amount of substance in the object.

D is inversely proportional to the acceleration of the object.

16 Which of the following gives the approximate ratio of the separation of the molecules in water and in steam at atmospheric pressure?

	Water : Steam
A	1 : 1
B	1 : 10
C	1 : 100
D	1 : 1000

17 The density of mercury is 13600 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 x distance moved in the direction of the force
B Force x velocity
C Work done x time taken
D Work done ÷ time taken

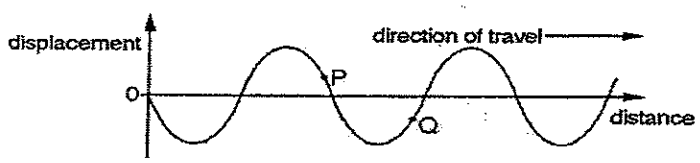
19 Which statement applies to the boiling but not to the evaporation of a liquid?

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 A transverse progressive wave travels along a rope. The graph shows the variation of displacement with distance along the rope, at a certain time. The wave is traveling to the right.



In which direction are **P** and **Q** moving?

	Movement of P	**Movement of Q**
A	Downwards	Downwards
B	Downwards	Upwards
C	Upwards	Downwards
D	Upwards	Upwards

22 Fig 22 represents the simple harmonic motion of a particle in a progressive wave traveling at a speed of 5.0 kms^{-1}

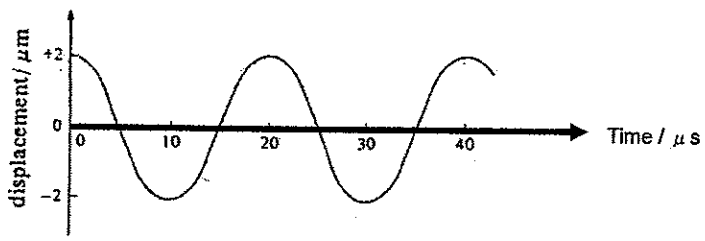


Fig 22

What is the wavelength?

A 10 mm
B 20 mm
C 50 mm
D 100 mm

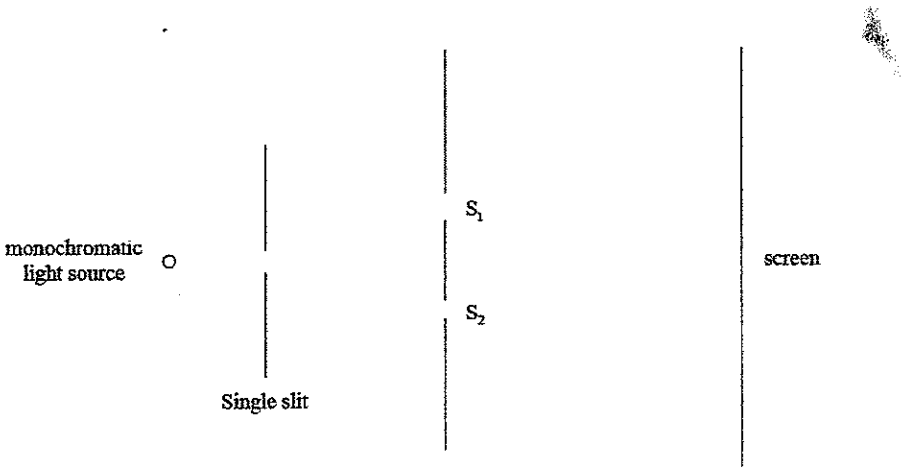
23. A sound wave of frequency 400 Hz is traveling in air at a speed of 320 ms^{-1}. What is the difference in phase between two points on the wave 0.2 m apart in the direction of travel?

A $\pi/4$ rad
B $\pi/2$ rad
C $4\pi/5$ rad
D $8\pi/5$ rad

24 Light can exhibit all the properties listed. Which property can sound not exhibit?

A Interference
B Polarisation
C Refraction
D Total internal reflection

25 In the diagram below, monochromatic light from a single narrow slit falls on two narrow slits S_1 and S_2. A system of interference fringes is observed on the screen.



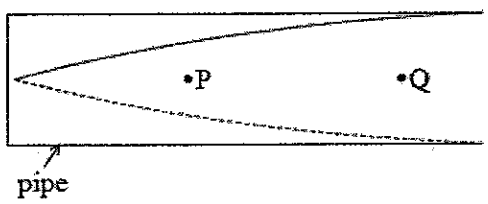
When the screen is moved further away from S_1 and S_2, which one of the following correctly describes what happens to the intensity of the bright fringes and the spacing of the bright fringes?

	Intensity of the bright fringes	**Spacing of the bright fringes**
A	Remains the same	Increases
B	Stays the same	Decreases
C	Deceases	Increases
D	Decreases	Decreases

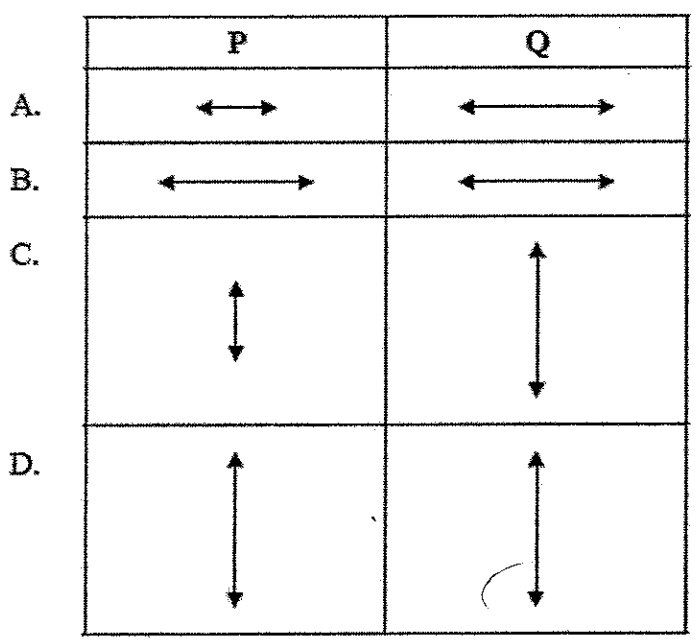
26 A parallel light beam of wavelength 540 nm is incident normally onto a diffraction grating which has 5000 lines per cm. What is the maximum number of orders of maxima which can be formed on both sides of the central maximum?

A 2 **B** 3 **C** 4 **D** 5

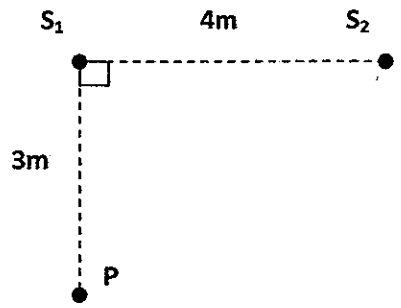
27 The diagram below represents the standing wave of sound inside a pipe.



Which of the following correctly represents the displacement of the air at P and Q?



28 Water waves of wavelength 2 m are produced by two generators, S_1 and S_2, placed 4 m apart. Each generator, when operated by itself, produces waves which have an amplitude A at **P**, which is 3 m from S_1 as shown in the diagram.



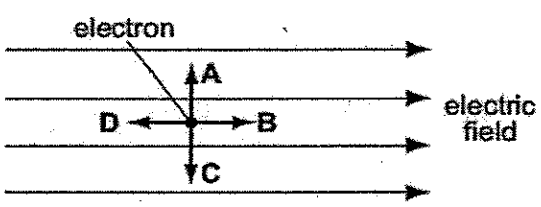
When the generators are operating in phase, the amplitude of oscillation at **P** is

A 0
B $1/2A$
C A
D $2A$

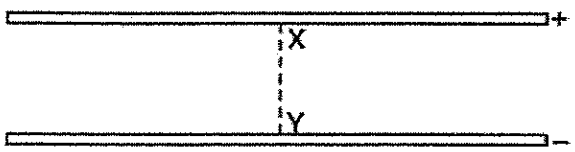
29 Electric field strength is defined as

A product of force and displacement
B force per unit displacement
C product of force and charge
D force per unit positive charge

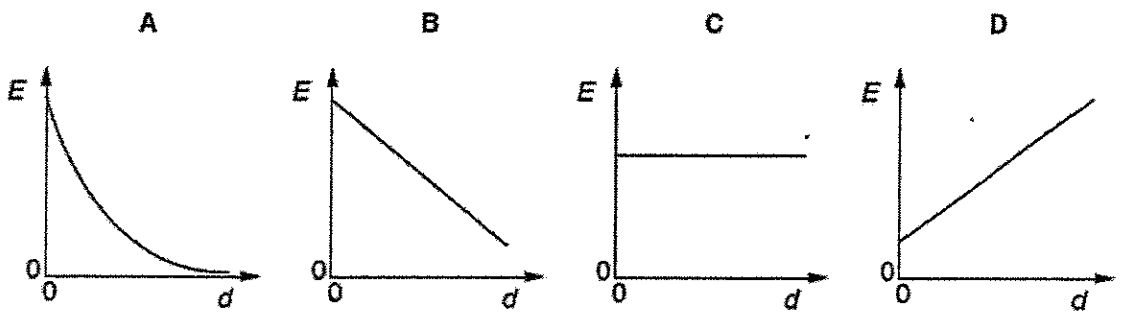
30 The diagram shows an electron in a uniform electric field. In which direction will the field accelerate the electron?



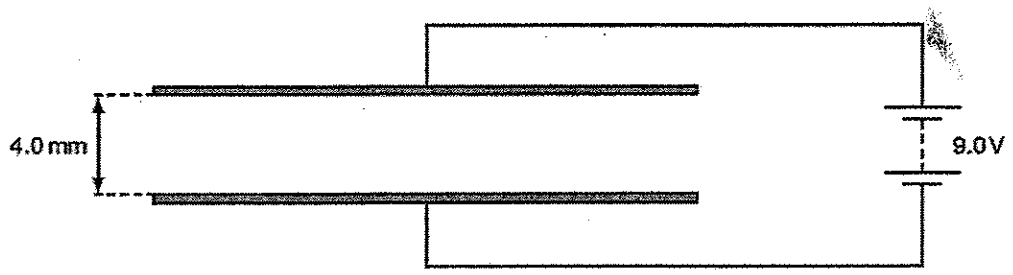
31 An electric field exists in the space between two charged metal plates.



Which of the following graphs shows the variation of electric field strength E with distance d from **X** along line **XY**?



32 The diagram shows a pair of metal plates 4.0 mm apart connected to a 9.0 V.



What is the electric field between the plates?

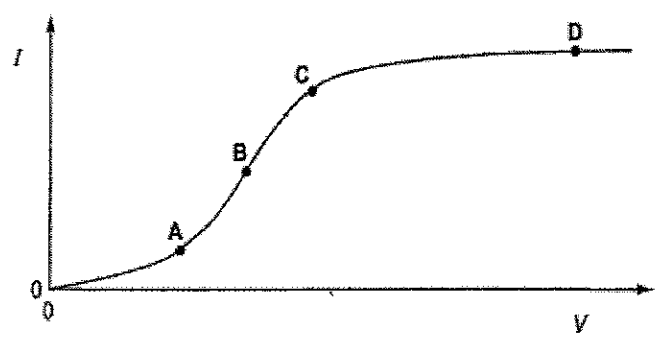
A $4.4 \times 10^{-4}\ NC^{-1}$

B $3.6 \times 10^{-2}\ NC^{-1}$

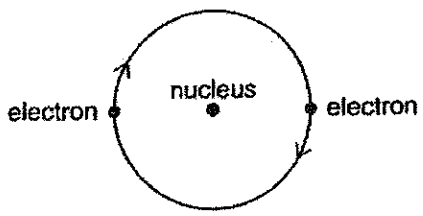
C $36\ NC^{-1}$

D $2.3 \times 10^{3}\ NC^{-1}$

33 The graph shows how the electric current I through a conducting liquid varies with the potential difference V across it. At which point on the graph does the liquid have the smallest resistance?



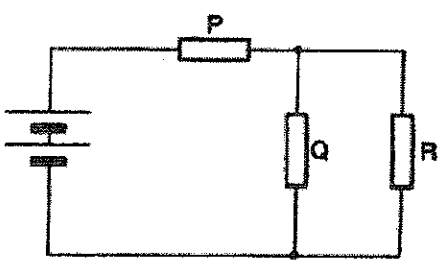
34 The diagram shows a model of an atom in which two electrons move round a nucleus in a circular orbit. The electrons complete one full orbit in 1.0×10^{-15}s.



What is the current caused by the motion of the electrons in the orbit?

A. 1.6×10^{-34}A
B. 3.2×10^{-34} A
C. 1.6×10^{-4} A
D. 3.2×10^{-4} A

35 The resistance **P**, **Q** and **R** in the circuit has equal resistance.

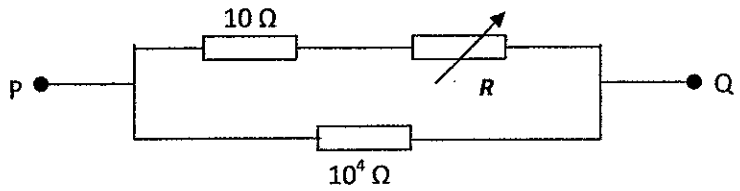


The battery, of negligible internal resistance, supplies a total power of 12W.

What is the power dissipated by heating in resistor **R**?

A 2W B 3W C 4W D 6W

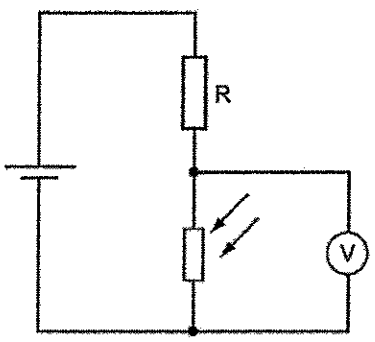
36 In the diagram below, the variable resistor ***R*** can be adjusted over its full range from zero to $10^3\ \Omega$.



What are the approximate limits for the resistance between P and Q?

A zero to $10^3\Omega$ **B** zero to $10^4\ \Omega$ **C** 10 to $10^3\ \Omega$ **D** 10 to $10^4\ \Omega$

37 A potential divider consists of a fixed resistor *R* and a light-dependent resistor (LDR).



What happens to the voltmeter reading and why does it happen, when the intensity of the LDR increases?

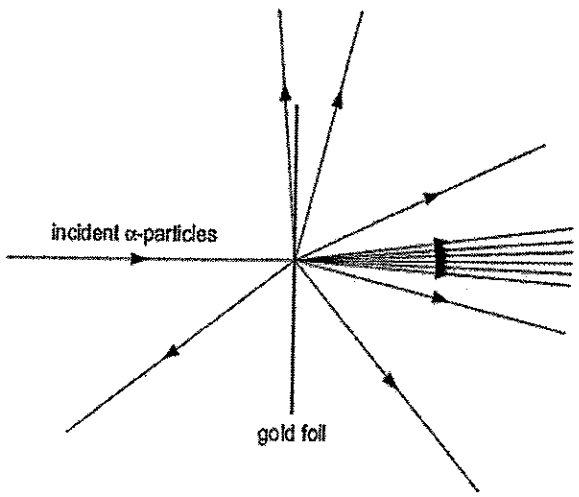
A The voltmeter reading decreases because the LDR resistance decreases.

B The voltmeter reading decreases because the LDR resistance increases.

C The voltmeter reading increases because the LDR resistance decreases.

D The voltmeter reading increases because the LDR resistance increases.

38 A thin gold foil is bombarded with α-particles as shown.



What can be deduced from this experiment?

A the binding energy of a gold nucleus.
B the energy levels of electrons in gold atoms.
C the small size of a gold nucleus.
D the structure of a gold nucleus.

39 Each of the nuclei below is accelerated from rest through the same potential difference.

Which one completes the acceleration with the lowest speed?

A ${}_{1}^{1}H$ B ${}_{2}^{4}H$ C ${}_{3}^{7}Li$ D ${}_{4}^{9}Be$

40 Which statement concerning an α-particle is correct?

A An α-particle has charge + 4e.
B An α-particle is a helium atom.
C When α-particles travel through air, they cause ionization.
D When α-particles travel through a sheet of gold foil, they make the gold radioactive.