

1. Which quantity has the same base units as  $\frac{1}{2} \rho v^2$ , where  $\rho$  is density and  $v$  speed?

A. Momentum  
 B. Upthrust  
 C. Electric field strength  
 D. Pressure

2. A derived quantity  $Y$  is defined as  $Y = \frac{k^4(a-b)^2}{c}$ , where  $a$ ,  $b$  and  $c$  are measured quantities and  $k$  is a constant.  $\Delta a$ ,  $\Delta b$  and  $\Delta c$  are the associated measurement error.

The fractional uncertainty of  $\frac{\Delta Y}{Y}$  is given by

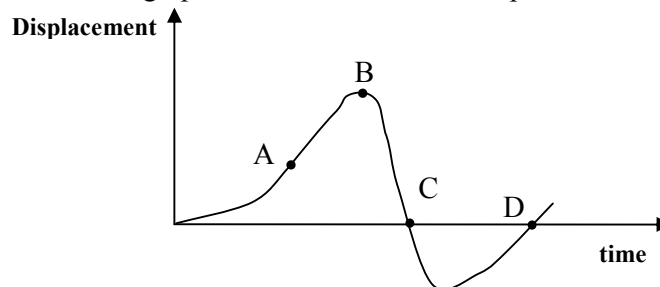
- A.  $\frac{4\Delta k}{k} + \frac{2\Delta a}{a} + \frac{2\Delta b}{b} + \frac{\Delta c}{c}$       C.  $\frac{2(\Delta a + \Delta b)}{a-b} + \frac{\Delta c}{c}$   
 B.  $\frac{2\Delta a}{a} + \frac{2\Delta b}{b} + \frac{\Delta c}{c}$       D.  $\frac{(\Delta a + \Delta b)}{a+b} + \frac{\Delta c}{c}$

3. 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  $25^\circ\text{C}$  to  $80^\circ\text{C}$ . What is the percentage uncertainty in the measurement of the temperature rise?

A. 0.5 %      C. 1 %  
 B. 0.9 %      D. 2 %

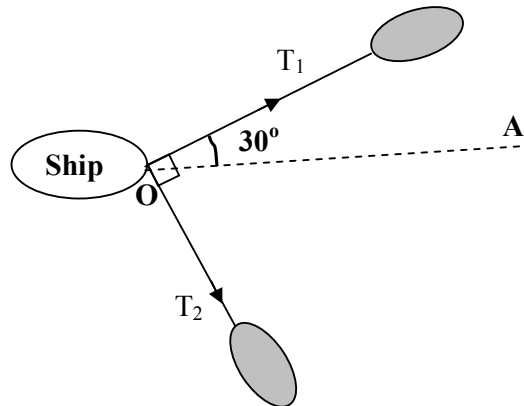
4. A car is traveling along a straight road. The graph shows the variation with time of its displacement during part of the journey.

Which point on the graph indicates that the car stops momentarily?



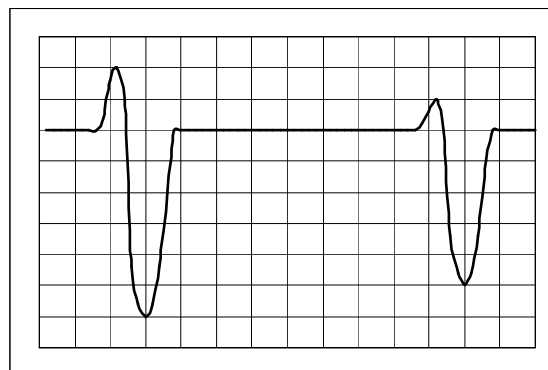
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5. A ship, located at O, is towed by two boats by steel cables as shown in the diagram.



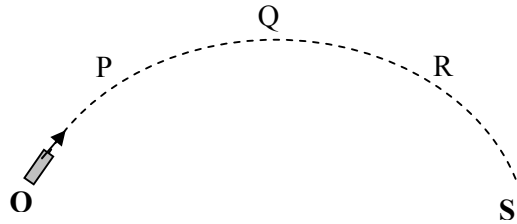
Tensions on the cables are  $T_1$  and  $T_2$ , respectively and they are at right angles to each other. The ship moves along the direction of OA which is  $30^\circ$  from  $T_1$ . What probably is the ratio of  $T_1$  and  $T_2$ ?

- A. 3 : 1  
B. 5 : 3  
C. 2 : 1  
D. 2 : 3
6. An ultrasonic pulse is transmitted to the seabed. The reflected pulse is detected and both are recorded in a cathode-ray oscilloscope (CRO) as shown in the diagram. The Y- plate is set at 2V per division and time-base 5 ms per division.
- What is the time interval between the two pulses?



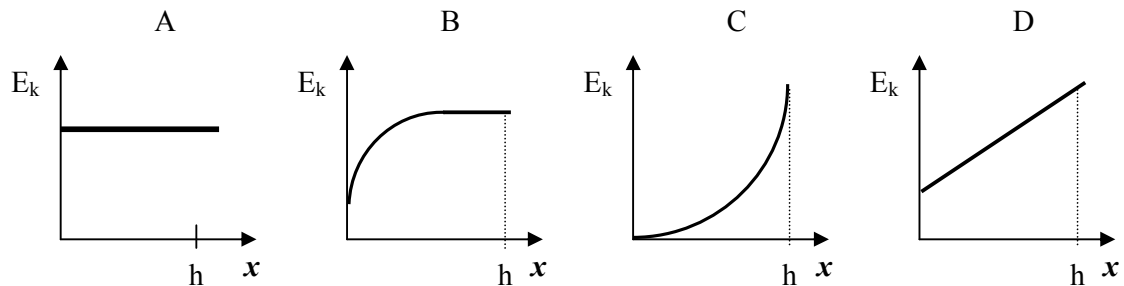
- A. 0.010 s  
B. 0.020 s  
C. 0.045 s  
D. 0.100 s

7. A projectile is launched at a 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.
8. A projectile is thrown horizontally off the edge of a tall building which height is  $h$  metres. Which of the following graphs most closely represents the variation of kinetic energy of the projectile,  $E_k$  with the distance it moves,  $x$ ? Air resistance may be neglected.



9. An engine exerts a thrust of  $F$  newtons to accelerate a box of mass  $m$  from rest to  $v \text{ ms}^{-1}$  in  $t$  seconds. By ignoring the frictions, power generated by the engine is given by \_\_\_\_\_.
- A.  $\frac{1}{2} F v$
  - B.  $F v$
  - C.  $F v t$
  - D.  $\frac{1}{2} m v^2$

10. Which of the following statements is correct?

- A. A force is required to keep a body moving on.
- B. The force acting on a body is proportional to the change of momentum of the body
- C. The total momentum of a system is constant as long as it is a head-on collision.
- D. A mass accelerates uniformly when the resultant force acting on it is constant.

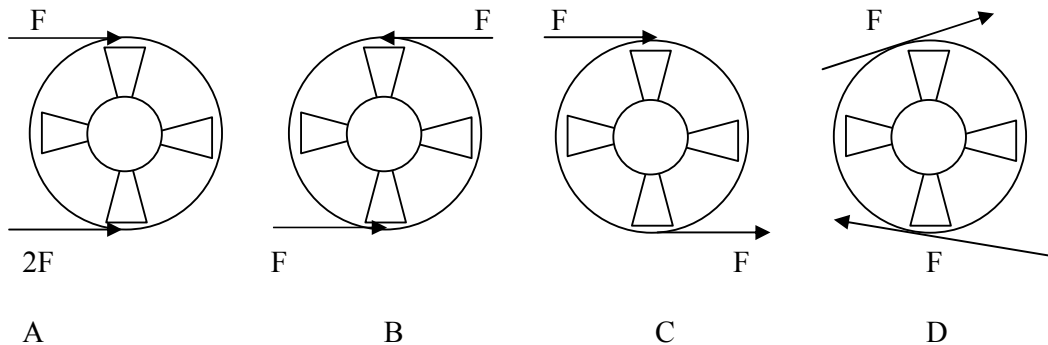
11. A hot balloon is ascending steadily in still air. It is acted on by three forces, the weight of the balloon  $W$ , upthrust  $U$  and force due to air resistance  $R$ . Which of the following statements is correct?

- A.  $U > W + R$
- B.  $U = W + R$
- C.  $R + U = W$
- D.  $W = U = R$

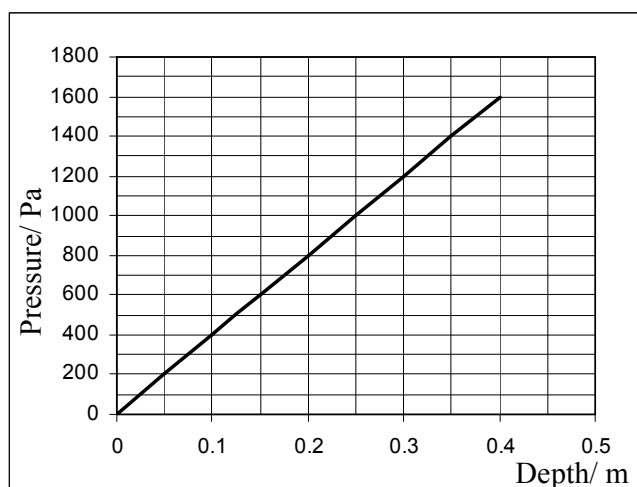
12. A cylindrical block of wood has a cross-sectional area  $A$  and weight  $W$ . It is totally immersed in water with its axis vertical. The block experiences pressures  $p_1$  and  $p_0$  at its top and bottom surfaces respectively. Which of the following expressions is equal to the upthrust on the block?

- |                        |                        |
|------------------------|------------------------|
| A. $(p_0 - p_1) A + W$ | C. $(p_0 - p_1) A$     |
| B. $(p_0 - p_1)$       | D. $(p_0 - p_1) A - W$ |

13. Which of the following pairs of forces, acting on a wheel, constitutes a couple?

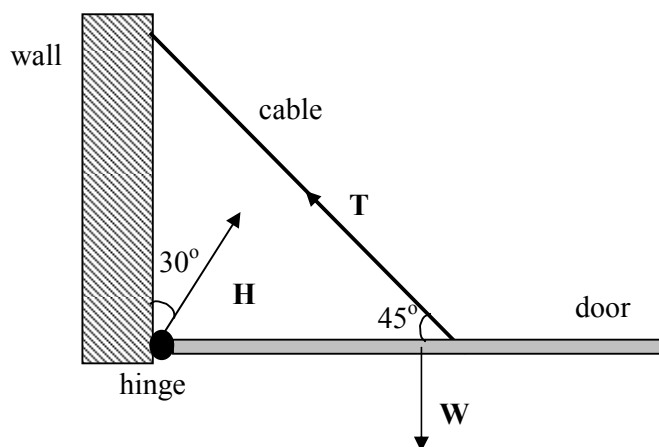


14. The graph shows how the pressure exerted by a liquid varies with depth below the surface.



What is the density of the liquid?

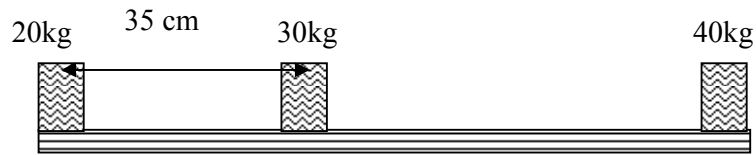
- A.  $200 \text{ kg m}^{-3}$                       C.  $2000 \text{ kg m}^{-3}$   
 B.  $400 \text{ kg m}^{-3}$                       D.  $4000 \text{ kg m}^{-3}$
15. A hinged door is held closed in the horizontal position by a cable. Three forces act on the door, the weight  $W$  of the door, the tension  $T$  in the cable and the force  $H$  at the hinge, as shown in the diagram.



Which list gives three forces in **increasing** order of magnitude?

- A.  $T, W, H$                       C.  $T, H, W$   
 B.  $H, T, W$                       D.  $W, H, T$

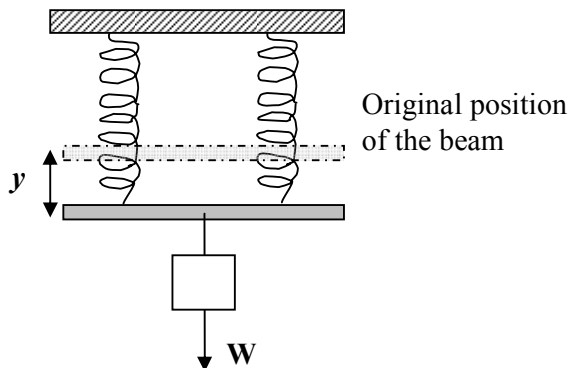
16. Three loads of mass 20 kg, 30 kg and 40 kg respectively are placed on a beam of 1 m long and of negligible mass.



What is the distance, from the load 40 kg, should a fulcrum be located to balance the beam?

- A. 0.21 m                                      C. 0.44 m  
B. 0.32 m                                      D. 0.55 m
17. For a given liquid at atmospheric pressure, which process can occur at any temperature?
- A. boiling  
B. evaporation  
C. melting  
D. solidification
18. What is the Young modulus of a material?
- A.  $(\text{force} \times \text{original length}) / (\text{extension} \times \text{cross-sectional area})$   
B.  $(\text{force} \times \text{cross-sectional area}) / (\text{extension} \times \text{original length})$   
C. strain / stress  
D. force / cross-sectional area

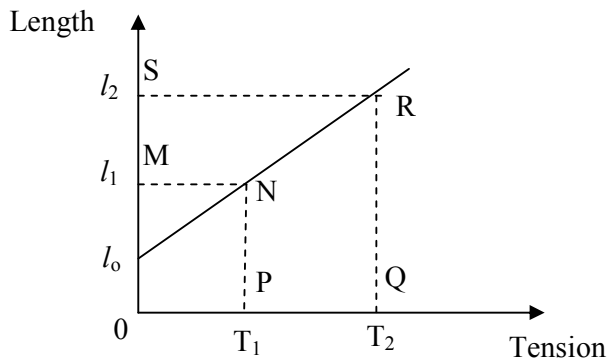
19. A beam, the weight of which may be neglected, is supported by two identical springs. When a weight  $W$  is hung from the middle, the extension of each spring is  $y$ .



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.  $\frac{4}{3}y$

20. The tension in a spring of natural length  $l_0$  is first increased from zero to  $T_1$ , causing the length to increase to  $l_1$ . The tension is then further increased to  $T_2$ , causing length to increase to  $l_2$ .



Which area of graph represents the work done by the spring during this further increase in length?

- A. SRNM  
B. PNRQ  
C. OLRQ  
D. SRQPNM

21. Which of the following summarises the change in wave characteristics from microwaves to ultra-violet light in the electromagnetic spectrum?

	Frequency	Interference fringe separation due to two coherent sources
A	decreases	increases
B	decreases	decreases
C	increases	increases
D	increases	decreases

22. Which is the most correct statement about wave?

- A A progressive wave has a node at the beginning
- B A transverse wave cannot be reflected
- C A transverse wave cannot be polarized
- D Sound can form stationary waves

23. At a distance 20m from a small loudspeaker, the amplitude of the sound heard is 0.012 mm. At what distance from the loudspeakers, is the amplitude 0.024mm?

- A. 40 m                      B. 14 m                      C. 10 m                      D. 5 m

24. Coherent light is incident on two fine parallel slits,  $S_1$  and  $S_2$ , as shown in the diagram.



If a bright fringe occurs at  $P$ , which of the following gives possible phase differences for the light waves arriving at  $P$  from  $S_1$  and  $S_2$ ?

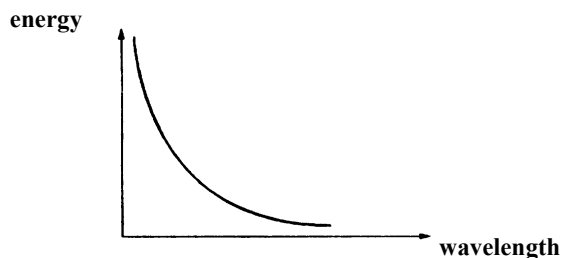
- A.  $\pi, 3\pi, 5\pi \dots$
- B.  $2\pi, 4\pi, 6\pi \dots$
- C.  $\pi, 2\pi, 3\pi \dots$
- D.  $\pi/2, 3\pi/2, 5\pi/2 \dots$



25. Illuminated normally, a diffraction grating produces second-order bright images with an angle of  $60^\circ$  between them. The light is monochromatic and has a wavelength 480 nm. The spacing of the grating in **mm** is

A.  $1.9 \times 10^{-3}$       B.  $1.6 \times 10^{-3}$       C.  $1.2 \times 10^{-3}$       D.  $8 \times 10^{-3}$

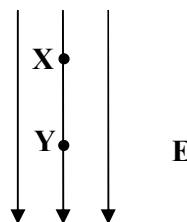
26. The diagram shows the relationship between the energy of electromagnetic radiation and the wavelength of the waves.



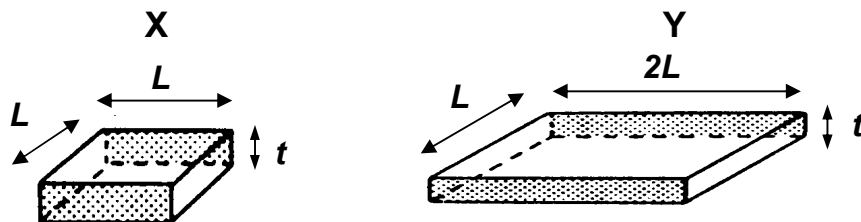
Which of the following has the lowest energy?

- A. infrared  
B. microwaves  
C. ultra-violet  
D. X-rays
27. A charge of 3C experiences a force of 3000 N when it is moved in a uniform electric field, E. What is the potential difference between two points X and Y separated by a distance of 1 cm

A. 0 V  
B. 10 V  
C. 1000 V  
D. 9000 V



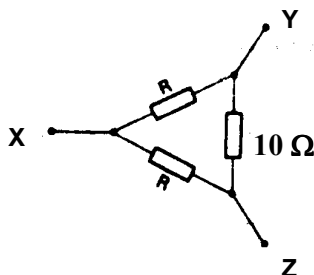
28. The diagram shows two squares, **X** and **Y**, cut from a sheet of metal of uniform thickness  $t$ . The dimensions of **X** and **Y** are shown in the diagram.



The resistances of the squares,  $R_X$  and  $R_Y$ , are measured between the opposite faces shaded in the diagram. What is the value of  $\frac{R_X}{R_Y}$ ?

- A. 1                      B. 2                      C. 3                      D. 4

29. The diagram shows a network of three resistors. Two of these marked  $R$  are identical. The other one has a resistance of  $10\ \Omega$ .



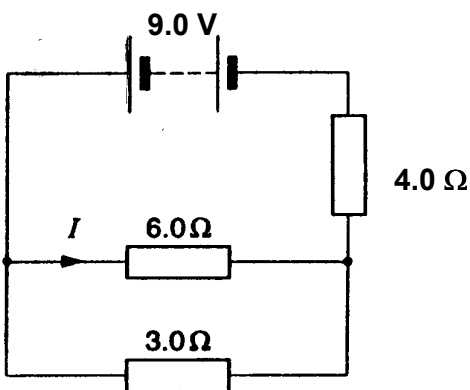
The resistance between **Y** and **Z** is found to be  $5\ \Omega$ . What is the resistance between **X** and **Y**?

- A.  $3.8\ \Omega$                       B.  $5.8\ \Omega$                       C.  $1.8\ \Omega$                       D.  $7.6\ \Omega$

30. A cell of e.m.f.  $E$  delivers a charge  $Q$  to an external circuit. Which statement is correct?

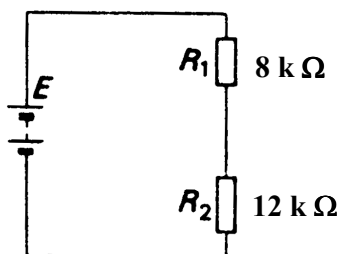
- A. The energy dissipation in the external circuit is  $EQ$   
 B. The energy dissipation within the cell is  $EQ$   
 C. The external resistance is  $EQ$   
 D. The total energy dissipation in the cell and the external circuit is  $EQ$

31. The diagram shows a circuit in which the battery has negligible internal resistance.



What is the value of the current  $I$ ?

- A. 0.5 A                      B. 1.0 A                      C. 1.5 A                      D. 2.0 A
32. An electrical source with internal resistance  $r$  is used to operate a lamp of resistance  $R$ . What fraction of the total power is delivered to the lamp?
- A.  $\frac{R}{R+r}$                       B.  $\frac{R+r}{R}$                       C.  $\frac{R}{r}$                       D.  $\frac{r}{R}$
33. A battery of e.m.f.  $E$  and negligible internal resistance is connected to 2 resistors of resistances  $R_1$  and  $R_2$  as shown in the circuit diagram.



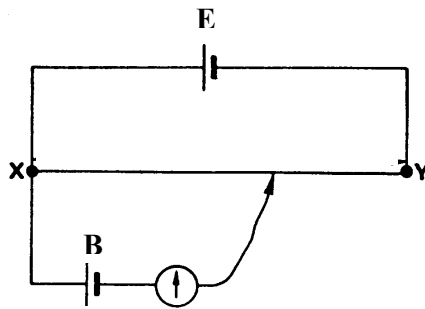
What is the potential difference across the resistor of resistance  $R_2$ ?

- A.  $\frac{3}{2}E$                       B.  $\frac{2}{3}E$                       C.  $\frac{3}{5}E$                       D.  $\frac{1}{2}E$

34. Each of Kirchhoff's law is linked to the conservation of a physical quantity. What physical quantity is assumed to be conserved in the formulation of Kirchhoff's first and second law?

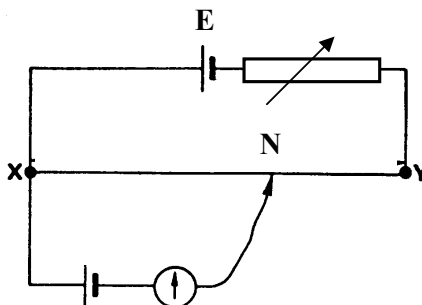
	Kirchhoff's first law	Kirchhoff's second law
A	energy	charge
B	energy	momentum
C	charge	energy
D	momentum	energy

35. In the circuit shown, cell E has a constant e.m.f. of 2.0V and negligible internal resistance. Wire XY is 100 cm long and has a resistance of  $4.0\ \Omega$ . Cell B has an e.m.f. of 1.5 V and an internal resistance of  $10\ \Omega$ . What is the balance length when a  $1.0\ \Omega$  resistor is placed in series with cell B?



- A. 12.5 cm      B. 25.0 cm      C. 50.0 cm      D. 75.0 cm

36. In the potentiometer circuit below, the moveable contact is placed at N on the bare wire XY, such that the galvanometer shows zero deflection.

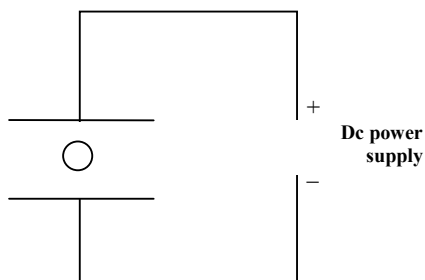


The resistance of the variable resistor is now decreased.

What is the effect of this decrease on the potential difference across the wire XY and on the position of the moveable contact for zero deflection?

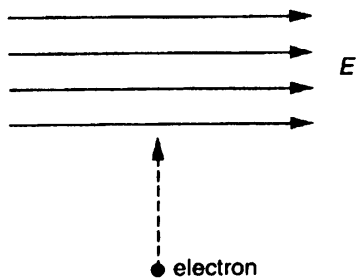
	Potential difference across XY	Position of moveable contact
A	increases	nearer to X
B	increases	nearer to Y
C	decreases	nearer to X
D	decreases	nearer to Y

37. A negatively charged particle is held stationary between two horizontal charged conducting plates, as shown in the diagram below.  
Which of the following changes would cause the particle to move downwards?



- A Increase the electric field strength
- B Increase the charge on the particle
- C Decrease the mass of the particle
- D Decrease the electric field strength

38. An electron ion is projected at right angles to a uniform electric field  $E$ .



In the absence of other fields, in which direction is the electron deflected?

- A to the right
  - B to the left
  - C into the plane of the paper
  - D out of the plane of the paper
39. Which is the most incorrect statement concerning radiation from radioactive materials?
- A Alpha-particles have positive charge
  - B Gamma rays are slightly deflected by a magnetic field
  - C Beta- particles can penetrates a very thin piece of paper
  - D An electric field can deflect alpha- and beta- particles.
40. As a result of successive decays in a radioactive series, the nucleon number of an isotope decreases by 4 while its proton number is unchanged. How many alpha particles and beta-particles are emitted?

	alpha	beta
A	1	2
B	1	4
C	2	1
D	2	2