

1989 Hong Kong Advanced Level Examination
AL Physics
Multiple Choice Question

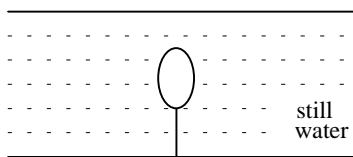
1. A micrometer screw gauge is used to measure the diameter of a piece of wire. The following readings were obtained:

mean zero reading -0.05 ± 0.02 mm,
 and
 mean apparent diameter $+1.05 \pm 0.02$ mm.

The diameter of the wire should be written as

- A. 1.00 ± 0.02 mm.
 B. 1.00 ± 0.04 mm.
 C. 1.10 ± 0.00 mm.
 D. 1.10 ± 0.02 mm.
 E. 1.10 ± 0.04 mm.

2.



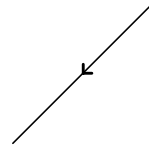
A wooden block of density 800 kg/m^3 and volume 1.0 m^3 is fastened to the bottom of a fresh-water pond as shown above. If the string suddenly breaks, the initial acceleration of the block will be close to

- A. 0.25 m/s^2 .
 B. 1.25 m/s^2 .
 C. 2.5 m/s^2 .
 D. 10 m/s^2 .
 E. 12.5 m/s^2 .
3. Two ships X and Y travel with equal speeds. X moves North and Y moves East. Which of the following best gives the direction of the velocity of X relative to Y ?

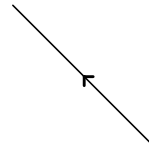
A.



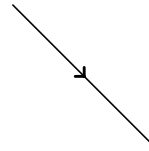
B.



C.



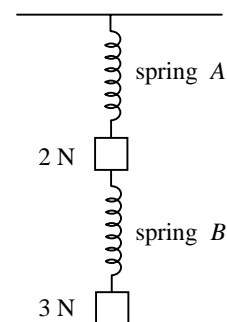
D.



E.



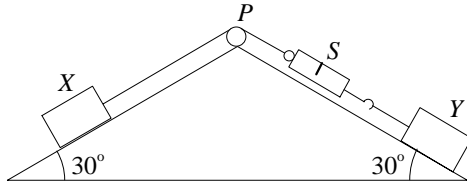
4.



Two objects of weights 2 N and 3 N are suspended from a fixed point by two identical light springs A and B as shown in the diagram. The force constants of the springs are both 1 N/cm . What are the extensions of springs A and B ?

	Extension of <u>spring A</u>	Extension of <u>spring B</u>
A.	5 cm	3 cm
B.	5 cm	2 cm
C.	3 cm	2 cm
D.	3 cm	5 cm
E.	2 cm	3 cm

5.



In the figure above, X and Y are blocks of mass 1 kg and 2 kg respectively. S is a spring balance of negligible mass and P is a smooth pulley fixed at the top of two smooth inclined planes. What is the reading of S when X is held stationary?

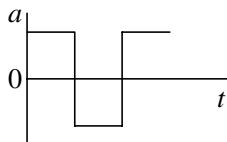
- A. 5 N
- B. 10 N
- C. 15 N
- D. 20 N
- E. 30 N

6. A ball bounces up and down on the ground in the vertical direction. Which of the following graphs best describes the variation of its acceleration a with time t ?

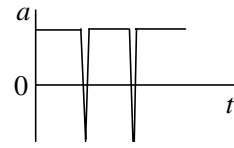
A.



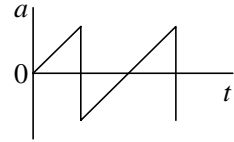
B.



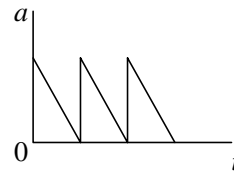
C.



D.



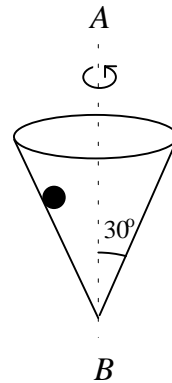
E.



7. A man weighs an object with a spring balance in a lift. Before the lift moves the scale reads 50 N. The lift goes down and then stops. The reading on the scale is

- A. 50 N throughout the journey.
- B. more than 50 N when the lift starts, and remains steady until it comes to rest.
- C. less than 50 N when the lift starts, and remains steady until it comes to rest.
- D. more than 50 N as the lift starts, and less than 50 N as it comes to rest.
- E. less than 50 N as the lift starts, and more than 50 N as it comes to rest.

8.



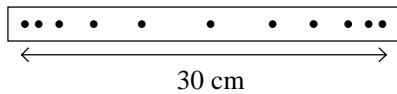
A smooth conical container rotates about the axis AB as shown. A marble remains at rest relative to the container at a radial distance r

from the axis. If the velocity of the marble is v , then v^2 is equal to

- A. $gr \sin 30^\circ$.
- B. $gr \tan 30^\circ$.
- C. $gr / \tan 30^\circ$.
- D. $gr \cos 30^\circ$.
- E. $gr / \cos 30^\circ$.

9.

Diagram NOT to scale



An object performs simple harmonic motion. A ticker-tape stuck to it records its positions at 0.020 s intervals for the first half cycle. The maximum speed of the object is

- A. 0.71 m/s.
- B. 2.36 m/s.
- C. 2.83 m/s.
- D. 4.71 m/s.
- E. 9.42 m/s.

10. A particle of mass 0.2 kg moves with S.H.M. of amplitude 0.05 m. If the total energy of the particle is 0.004 J, then its period of motion is

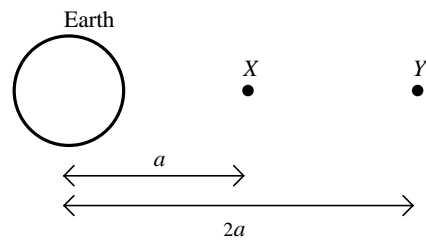
- A. $\pi/4$ s.
- B. $\pi/2$ s.
- C. $3\pi/4$ s.
- D. π s.
- E. 2π s.

11. Assuming the Earth to be a perfect sphere, what would its angular velocity of rotation have to be for an object at the equator to be weightless (i.e. to give a spring balance reading of zero)?

(Radius of the Earth = 6.4×10^6 m.)

- A. 2.4×10^{-12} rad/s
- B. 1.6×10^{-6} rad/s
- C. 1.3×10^{-3} rad/s
- D. 8.0×10^2 rad/s
- E. 6.4×10^5 rad/s

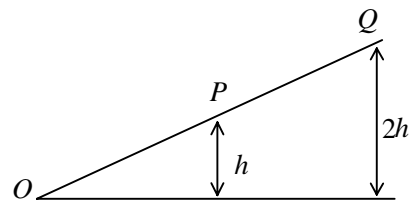
12.



Two points X and Y are at distances a and $2a$ from the centre of the Earth. The gravitational potential at X is -8 kJ/kg. When a 1 kg mass is taken from X to Y the work done on the mass is

- A. -4 kJ.
- B. -2 kJ.
- C. $+2$ kJ.
- D. $+4$ kJ.
- E. $+8$ kJ.

13.

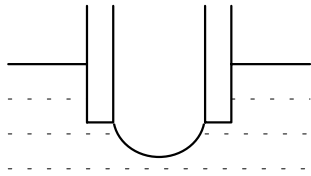


A ball rolls down an inclined plane. The ball is first released from rest from P and then later from Q . Which of the following statements is/are correct?

- (1) The ball takes twice as much time to roll from Q to O as it does to roll from P and O .
- (2) The acceleration of the ball at Q is twice as large as the acceleration at P .
- (3) The ball has twice as much K.E. at O when rolling from Q as it does when rolling from P .

- A. (1), (2) and (3)
- B. (1) and (2) only
- C. (2) and (3) only
- D. (1) only
- E. (3) only

14.

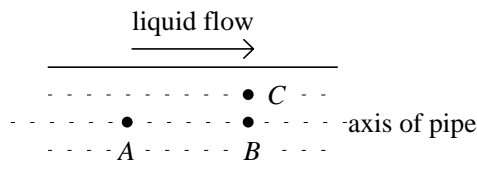


An air bubble is blown at the end of a capillary tube dipping into a liquid of surface tension T . The excess pressure needed to blow the bubble

- (1) is greatest at the beginning when one starts to blow.
- (2) is least when the bubble is a hemisphere.
- (3) is directly proportional to T .

- A. (1), (2) and (3)
- B. (1) and (2) only
- C. (2) and (3) only
- D. (1) only
- E. (3) only

15.



An incompressible viscous liquid flows along a horizontal pipe of uniform cross-sectional area under streamline conditions. Which of the following statements is/are correct?

- (1) The pressure at point A is greater than that at point B .
- (2) The speed of liquid flow is the same at points A and B .
- (3) The speed of liquid flow at C is less than that at B .

- A. (1), (2) and (3)
- B. (1) and (2) only
- C. (2) and (3) only
- D. (1) only
- E. (3) only

16. Two vessels of equal volume both contain an ideal gas and are connected by a tube of negligible volume. Initially both vessels are at temperature T_0 and pressure P_0 . One vessel is maintained at T_0 , while the temperature of the

other is raised to T . The new pressure is then given by

- A. P_0 .
- B. TP_0/T_0 .
- C. T_0P_0/T .
- D. $2TP_0/(T+T_0)$.
- E. $P_0(T+T_0)/2T_0$.

17. Two different gases A and B are contained in two identical vessels. If the ratio of their molecular masses and absolute temperatures are respectively $8 : 1$ and $2 : 1$, the ratio of their r.m.s. molecular speeds will be

- A. $1 : 4$.
- B. $1 : 2$.
- C. $1 : 1$.
- D. $2 : 1$.
- E. $4 : 1$.

18. The internal energy of an ideal gas at temperature T is $3CT/2$, where C is a constant. Given that R = the molar gas constant, N_A = Avogadro constant, k = Boltzmann constant, then for an ideal gas containing N molecules, the constant C is equal to

- A. $N_A R$.
- B. $N_A k$.
- C. NR/N_A .
- D. Nk/N_A .
- E. NR .

19. 1 mole of an ideal mono-atomic gas expands at a constant pressure of 10^5 Pa from a volume of 0.02 m³ to a volume of 0.03 m³. The increase in internal energy of the gas is

- A. 500 J.
- B. 667 J.
- C. 1 000 J.
- D. 1 500 J.
- E. 2 500 J.

20. A rotating disc, with a small hole near its edge is illuminated by a lamp which flashes at a rate of 50 times per second. The hole is observed to be moving backwards slowly relative to the

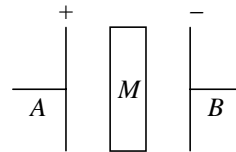
actual direction of rotation of the disc. The disc is probably rotating at

- A. 24 revolutions per second.
 B. 26 revolutions per second.
 C. 50 revolutions per second.
 D. 98 revolutions per second.
 E. 102 revolutions per second.
21. The coated lens of a camera appears purple in daylight. According to the manufacturers, the coating has a refractive index of 1.25 and the material of the lens has a refractive index of 1.50. If the wavelength of yellow light in air is 520 nm, the approximate thickness of the coating is
- A. 104 nm.
 B. 130 nm.
 C. 180 nm.
 D. 210 nm.
 E. 260 nm.
22. Light of wavelength λ is incident normally on a diffraction grating with p lines per millimetre. the second-order diffraction maximum is at an angle θ from the central position. For a second grating with $3p$ lines per millimetre illuminated normally by light of wavelength $5\lambda/4$, the angle between the first-order diffraction maximum and the central position is ϕ . Which of the following relations is correct ?
- A. $\sin \phi = (5 \sin \theta)/12$
 B. $\sin \phi = \sin (5 \theta/12)$
 C. $\sin \phi = \sin (15 \theta/4)$
 D. $\sin \phi = (15 \sin \theta)/8$
 E. $\sin \phi = \sin (15 \theta/8)$
23. If the threshold of hearing is 10^{-12} W/m², a sound level of one microwatt per m² is above threshold by
- A. 6 dB.
 B. 11 dB.
 C. 60 dB.
 D. 110 dB.
 E. 120 dB.
24. A stationary radar source emits waves of frequency f , and wavelength λ which are

reflected from an object moving towards the source at a speed u . The reflected waves reaching a receiver standing near to the radar source will have an apparent wavelength of

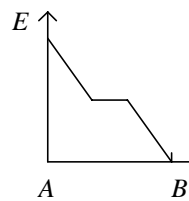
- A. $\lambda - 2u/f$.
 B. $\lambda - u/f$.
 C. λ .
 D. $\lambda + u/f$.
 E. $\lambda + 2u/f$.

25.

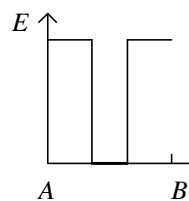


Two large metal plates A , B are oppositely charged and placed a small distance apart. A piece of metal M is placed centrally between the plates. Which of the following graphs shows the variation of electric field intensity E from A to B ?

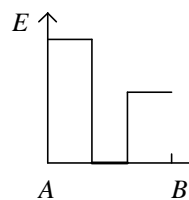
A.



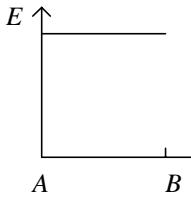
B.



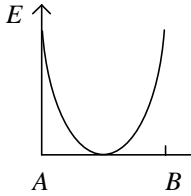
C.



D.



E.



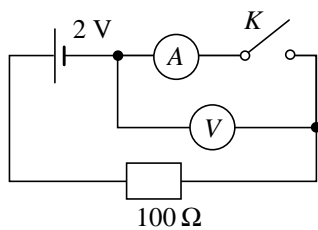
26. An isolated spherical conductor of radius r is charged to a potential V . The total electrical energy stored is

- A. $V^2/(8\pi\epsilon_0 r)$.
- B. $V^2/(4\pi\epsilon_0 r)$.
- C. $V^2/(2\pi\epsilon_0 r)$.
- D. $V^2 \times (2\pi\epsilon_0 r)$.
- E. $V^2 \times (4\pi\epsilon_0 r)$.

27. A capacitor is charged to a p.d. of 100 V and then connected across a resistor. After 1 s, the p.d. across the capacitor is 80 V. After another second, the p.d. across the capacitor will be

- A. 40 V.
- B. 56 V.
- C. 60 V.
- D. 64 V.
- E. 70 V.

28.

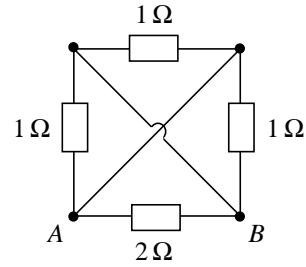


In the above circuit, V is a voltmeter of high internal resistance and A is an ammeter of low internal resistance. What is the voltmeter reading when (a) switch K is open, (b) switch K is closed?

K open K closed

- A. 0 V 0 V
- B. 0 V 2 V
- C. 1 V 1 V
- D. 2 V 0 V
- E. 2 V 2 V

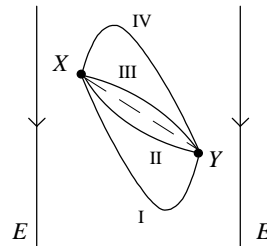
29.



In the above circuit, the equivalent resistance between A and B is

- A. $2/7 \Omega$.
- B. $2/5 \Omega$.
- C. $2/3 \Omega$.
- D. 2Ω .
- E. 5Ω .

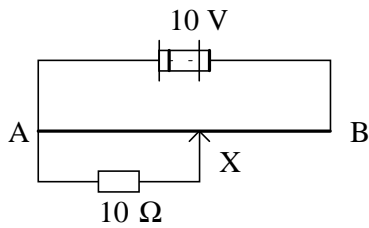
30.



A particle carrying a negative charge is free to move in a uniform electric field E . If the particle starts with a certain velocity from point X , which of the paths shown could represent the route which the particle would follow from X to Y ?

- A. I and II only
- B. I and IV only
- C. II and III only
- D. III and IV only
- E. I, II, III and IV

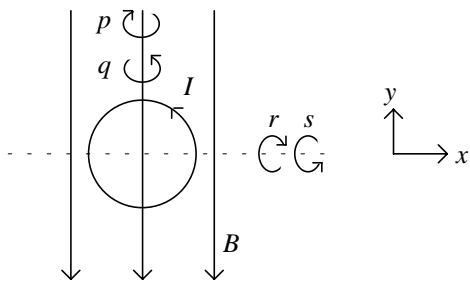
31.



In the above circuit, AB is a metre-wire of resistance $10\ \Omega$. When X is moved to the mid-point of AB , the p.d. across AX will be

- A. 2.5 V.
- B. 4.0 V.
- C. 5.0 V.
- D. 6.0 V.
- E. 7.5 V.

32.



A circular loop carrying a current I is placed in a uniform magnetic field B in the xy plane as shown. If the loop is free to move, the magnetic forces will cause it to

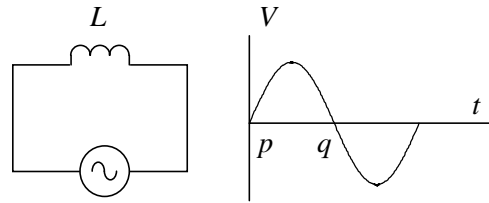
- A. rotate about the y -axis as indicated by p .
- B. rotate about the y -axis as indicated by q .
- C. rotate about the x -axis as indicated by r .
- D. rotate about the x -axis as indicated by s .
- E. remain stationary.

33. Which of the following statements about a d.c. motor is FALSE?

- A. The back e.m.f. developed dissipates the input energy in Joule heating.
- B. If the motor is stopped by some obstruction, the current through the coil will increase.
- C. The direction of rotation can be predicted by Fleming's left hand rule.
- D. A single-coil motor will not start when it is switched on, if the plane of the coil is perpendicular to the magnetic field.

E. An ideal d.c. motor develops a back e.m.f. equal to the applied e.m.f.

34.



The circuit diagram shows an alternating potential difference connected across an inductor L , and the graph shows the variation of the source voltage V with time t . Which of the following is/are correct?

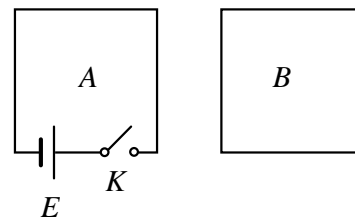
- (1) At time p , both the current through L and the p.d. across it are zero.
- (2) The current through L and the p.d. across it are 180° out of phase.
- (3) At time q , the current through L is at its maximum value.

- A. (1), (2) and (3)
- B. (1) and (2) only
- C. (2) and (3) only
- D. (1) only
- E. (3) only

35. A length of wire is bent to form a circular coil of one turn. The coil is placed in a uniform magnetic field with its plane normal to the direction of the field. The flux linkage through the coil is ϕ . The same length of wire is now bent to form a double loop of smaller radius. The flux linkage is now

- A. $\phi/4$.
- B. $\phi/2$.
- C. ϕ .
- D. 2ϕ .
- E. 4ϕ .

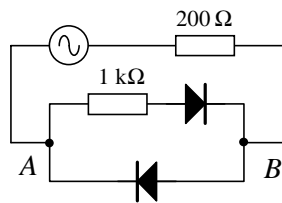
36.



Two rectangular wire loops *A* and *B* are placed in the same plane. Loop *A* includes a battery *E* and switch *K*, which is initially open. If *K* is suddenly closed, what is the direction of the induced current in loop *B*? Is the force between the two loops attractive or repulsive?

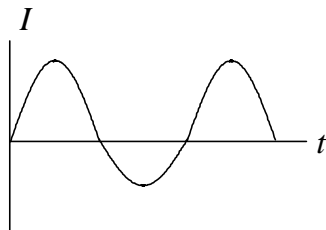
	<u>Direction of current</u>	<u>Nature of force</u>
A.	clockwise	attractive
B.	clockwise	repulsive
C.	anticlockwise	attractive
D.	anticlockwise	repulsive
E.	no current	no net force

37.

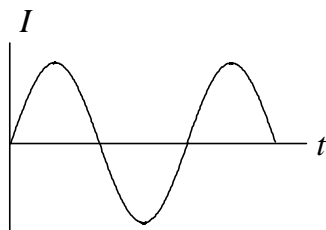


Which of the following graphs best represents the variation with time *t* of the current *I* through the segment *AB* in the above circuit?

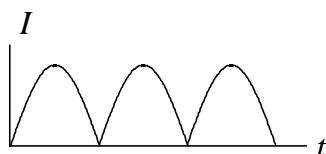
A.



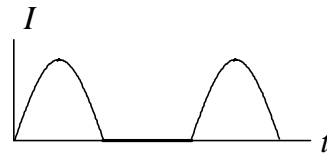
B.



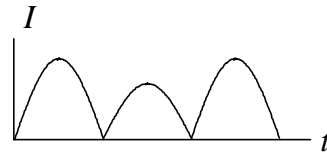
C.



D.

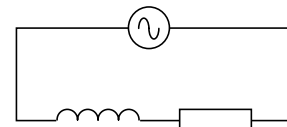


E.



38.

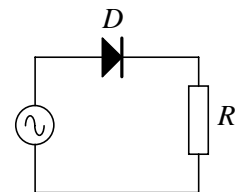
6 V r.m.s.



An ideal inductor of reactance 1Ω and an ideal resistor of resistance 2Ω are joined in series across the terminals of a 6 V r.m.s. a.c. source as shown. The power dissipated in the circuit is

- A. 8 W.
- B. 12 W.
- C. 14.4 W.
- D. 16.1 W.
- E. 18 W.

39.



In the above circuit, *D* is an ideal diode, *R* is a resistor of resistance $5 \text{ k}\Omega$ and the alternating e.m.f. is represented by the equation

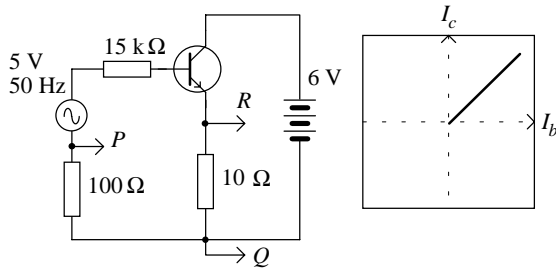
$$E = 10 \cos(5\pi t),$$

Where *E* is in volts and *t* is in seconds. The power dissipated in *R* is

- A. zero.
- B. 2.5 mW.
- C. 5 mW.

- D. 10 mW.
E. 20 mW.

40.



A CRO is used to display the current transfer characteristic curve of a transistor. How should points P , Q and R be connected to the X-input, Y-input and the earth terminal of the CRO?

	X-input	Y-input	Earth
A.	P	Q	R
B.	P	R	Q
C.	Q	P	R
D.	Q	R	P
E.	R	P	Q

41. A gold-leaf electroscope is positively charged. Which of the following objects when placed near the cap, will cause the leaf of the electroscope to fall?

- (1) a lighted match
(2) a strong α -source
(3) an earthed metal plate

- A. (1), (2) and (3)
B. (1) and (2) only
C. (2) and (3) only
D. (1) only
E. (3) only

42. When a beam of white light passes through iodine vapour, the spectrum of the emergent light shows dark lines. Which of the following statements is/are correct?

- (1) The iodine vapour absorbs from the light all frequencies except those which it emits.
(2) The iodine vapour emits less energy than it absorbs.

(3) The iodine vapour absorbs the same frequencies as it emits.

- A. (1), (2) and (3)
B. (1) and (2) only
C. (2) and (3) only
D. (1) only
E. (3) only

43. A spherical drop of oil of mass m and radius r carries an electrical charge q . It is placed in air of viscosity η between two horizontal parallel plates. When an electric field E is set up between the plates the drop is driven upwards, reaching a terminal velocity v . If the upthrust due to displaced air is negligible, which of the following is an expression for v ?

- A. $mg / (6 \pi r \eta)$
B. $2mg / (9 \pi r \eta)$
C. $(mg - qE) / (6 \pi r \eta)$
D. $(qE - mg) / (6 \pi r \eta)$
E. $(qE + mg) / (6 \pi r \eta)$

44. An atom emits light of wavelengths 122 nm and 103 nm when one of its electrons returns to its ground state from its first and second excited states, respectively. The wavelength of light emitted when the electron passes from the second excited state to the first excited state is

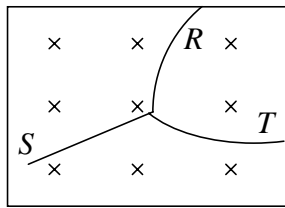
- A. 19 nm.
B. 112 nm.
C. 113 nm.
D. 225 nm.
E. 661 nm.

45. When light of wavelength 4.0×10^{-7} m is incident on the surface of a metal, the kinetic energy of the electrons emitted has a maximum value of 3.0×10^{-19} J. What is the longest wavelength of light which would cause electrons to be emitted from the metal?

$$\left(\begin{array}{l} \text{Planck constant} \\ \text{speed of light in air} \end{array} \right. = \begin{array}{l} 6.6 \times 10^{-34} \text{ Js,} \\ 3.0 \times 10^8 \text{ m/s} \end{array}$$

- A. 6.6×10^{-7} m
B. 1.0×10^{-6} m
C. 2.5×10^{-6} m
D. 9.8×10^5 m
E. 1.5×10^6 m

46.



A neutral particle decays in a short time into a proton and a negative particle. The initial and subsequent paths of the particles in a magnetic field acting into the plane of the paper are shown above. Which of the following gives the respective paths for the neutral particle, the proton and the negative particle?

	<u>Neutral particle</u>	<u>The proton</u>	<u>Negative particle</u>
A.	<i>R</i>	<i>S</i>	<i>T</i>
B.	<i>R</i>	<i>T</i>	<i>S</i>
C.	<i>S</i>	<i>R</i>	<i>T</i>
D.	<i>S</i>	<i>T</i>	<i>R</i>
E.	<i>T</i>	<i>R</i>	<i>S</i>

47. Which of the following statements is/are true for beta particles originating from nuclear disintegrations?

- (1) Beta particles travel at the speed of light.
- (2) Emitted beta particles from a nuclide have a continuous energy distribution.
- (3) Beta decay is accompanied by the emission of neutrinos.

- A. (1), (2) and (3)
- B. (1) and (2) only
- C. (2) and (3) only
- D. (1) only
- E. (3) only

48. A Geiger-Muller tube and a scaler record approximately 50 counts per second due to a radioactive source. What is the shortest counting time required so that the percentage error of the counts will not exceed 1%?

- A. 100 s
- B. 200 s
- C. 1 000 s
- D. 5 000 s
- E. 10 000 s

49. A helium atom, a hydrogen atom and a neutron have masses of 4.003 u, 1.008 u and 1.009 u (unified atomic mass units) respectively. Assuming that hydrogen atoms and neutrons can fuse to form helium, the binding energy of a helium nucleus is

- A. 0.0031 u.
- B. 0.031 u.
- C. 1.017 u.
- D. 2.014 u.
- E. 2.017 u.

50. If the kinetic energy of an electron is 10.0 eV, what is the wavelength of the de Broglie wave associated with it?

$$\left(\begin{array}{l} \text{Planck constant} = 6.63 \times 10^{-34} \text{ Js,} \\ \text{Charge of electron} = 1.60 \times 10^{-19} \text{ C,} \\ \text{Mass of electron} = 9.11 \times 10^{-31} \text{ kg} \end{array} \right)$$

- A. $4.1 \times 10^{-16} \text{ m}$
- B. $3.9 \times 10^{-10} \text{ m}$
- C. $5.5 \times 10^{-10} \text{ m}$
- D. $2.3 \times 10^{14} \text{ m}$
- E. $4.5 \times 10^{14} \text{ m}$

- End of Paper -

<u>Question No.</u>	<u>Key</u>	<u>Question No.</u>	<u>Key</u>
1.	E	26.	D
2.	C	27.	D
3.	C	28.	D
4.	A	29.	A
5.	B	30.	A
6.	C	31.	B
7.	E	32.	D
8.	C	33.	A
9.	B	34.	E
10.	B	35.	B
11.	C	36.	D
12.	D	37.	A
13.	E	38.	C
14.	E	39.	C
15.	A	40.	D
16.	D	41.	A
17.	B	42.	E
18.	C	43.	D
19.	D	44.	E
20.	D	45.	B
21.	A	46.	D
22.	D	47.	C
23.	C	48.	B
24.	A	49.	B
25.	B	50.	B