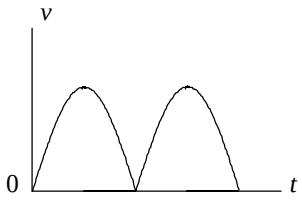
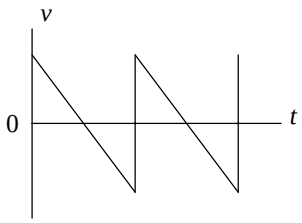
1983 Hong Kong Advanced Level Examination
AL Physics
Multiple Choice Question

1. A ball bounces up and down from the floor. Which of the following graphs shows the variation of its velocity v with time t?

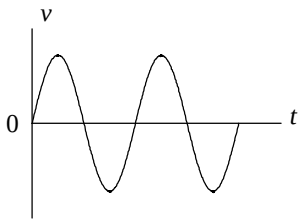
A.



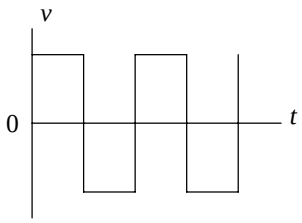
B.



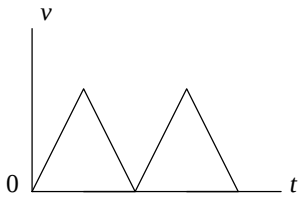
C.



D.



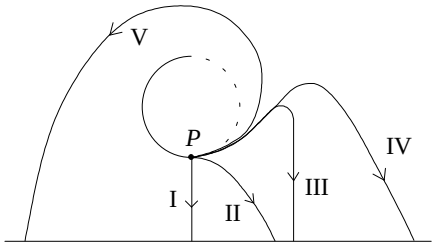
E.



2. A man is walking due east at 1.00 m/s on the deck of a ship streaming north at 1.73 m/s. In what direction will the man be walking relative to the surface of the earth?

A. N 30º E
B. N 60º E
C. NE
D. N 26.9º E
E. N 40.9º E

3.

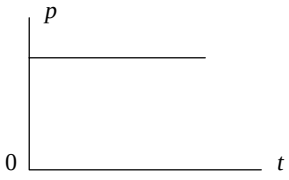


A boy is whirling a stone, tied to a piece of string, in a vertical circle as shown above. The string suddenly breaks at P. Which of the paths (I - V) represents a possible path for the stone from just before the string breaks until the stone hits the ground?

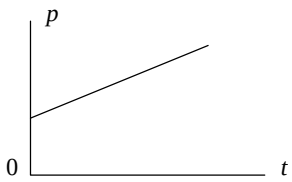
A. I
B. II
C. III
D. IV
E. V

4. A spaceship burns fuel and moves with constant acceleration in a straight line. Which of the graphs below best represents the variation of its momentum p with time t?

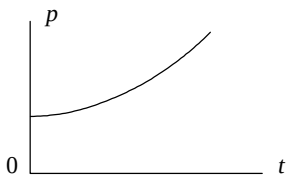
A.



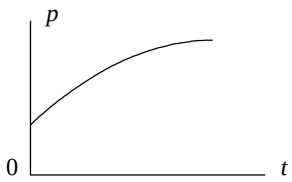
B.



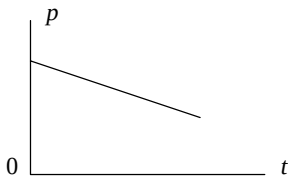
C.



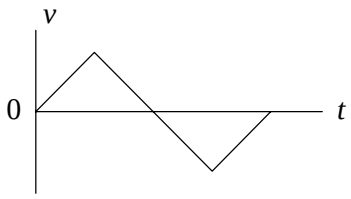
D.



E.

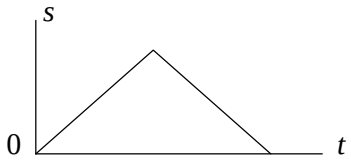


5.

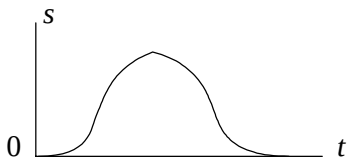


The velocity v of a particle varies with time t as shown. Which of the following graphs best represents the variation of the displacement s of the particle with time t?

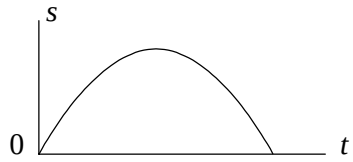
A.



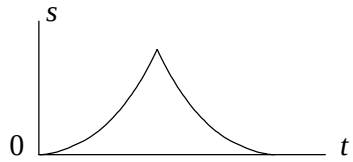
B.



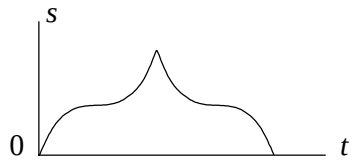
C.



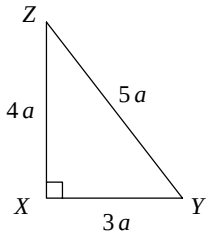
D.



E.



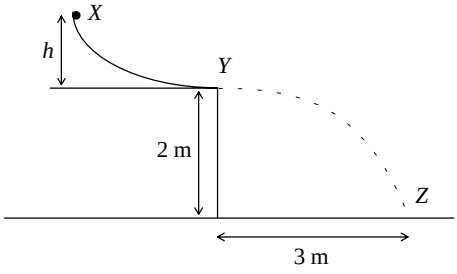
6.



XYZ is a rigid framework of rods of negligible mass. Three small bodies, each of mass M, are attached to the framework, one at each of the points X, Y and Z. The moment of inertia of the framework about an axis through X perpendicular to XYZ is

A. 12 Ma^2.
B. 25 Ma^2.
C. 27 Ma^2.
D. 98 Ma^2.
E. 144 Ma^2.

7.

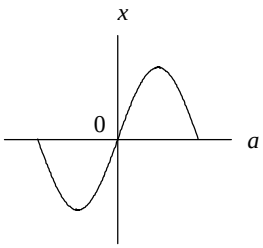


A particle is released from *X* and slips down a smooth curve to *Y*, at the edge of a table 2 m high, where it travels horizontally. It then leaves the table and travels freely under gravity until it hits the ground at *Z*, at a horizontal distance of 3 m from *Y*. The vertical distance, *h*, of *X* above *Y* is

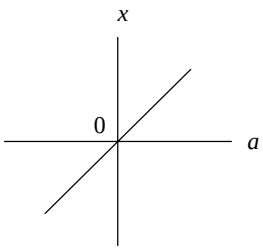
A. 9/8 m.
B. 4/3 m.
C. 2 m.
D. 3 m.
E. 4 m.

8. A body is moving with simple harmonic motion about point *O*. Which of the following graphs represents the variation of its displacement *x* from *O*, with its acceleration *a*?

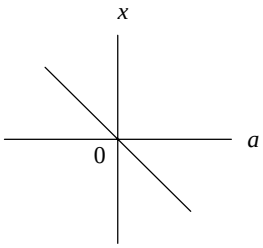
A.



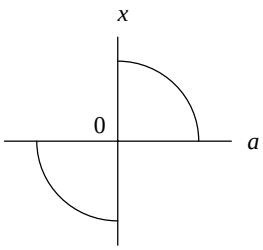
B.



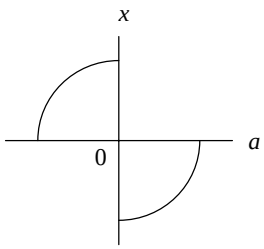
C.



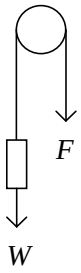
D.



E.



9.



A man pulls with force *F* on a rope passing over a pulley of radius *r* and moment of inertia *I* and raises a weight *W* at constant speed *v*. The kinetic energy of the system shown is

A. $Wv^2/2g + Iv^2/2$.
B. $Wv^2/2g + Iv^2/2r^2$.
C. $Wv^2/2 + Iv^2/2$.
D. $Wv^2/2 + Iv^2/2r^2$.
E. $Wv^2/2 + Ir^2v^2/2$.

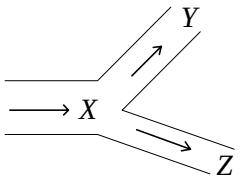
10. A sphere *X* of mass *m*, travelling with speed *u*, makes a head-on collision with a similar sphere *Y* which is at rest. After the collision the velocities of *X* and *Y* are v_1 and v_2 respectively. Which one of the following is a possible pair of values for v_1 and v_2?

	v_1	v_2
A.	$-u$	$2u$
B.	$u/4$	$3u/4$
C.	$3u/4$	$u/4$
D.	$u/\sqrt{2}$	$u/\sqrt{2}$
E.	$u/2$	$(u\sqrt{3})/2$

11. The capillary rise of water in a glass tube is 5 cm. When the same tube is dipped into a second liquid, of density three times the density of water, the capillary rise is 2.5 cm. The angle of contact is zero in each case. The ratio of the surface tension of the second liquid to that of water is

A. 1 : 6.
B. 2 : 3.
C. 3 : 2.
D. 3 : 1.
E. 6 : 1.

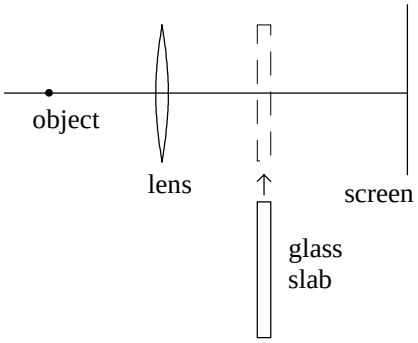
12.



A pipe *X* of cross-sectional area 24 cm² branches into two smaller pipes, *Y* of area 15 cm² and *Z* of area 6 cm². An incompressible liquid flows through the pipes and travels at a speed of 0.4 m/s in *X* and 0.6 m/s in *Y*. What is the speed of the fluid in *Z*?

A. 0.1 m/s
B. 0.2 m/s
C. 1.0 m/s
D. 1.5 m/s
E. 1.6 m/s

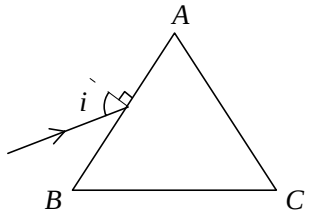
13.



A converging lens forms a sharp image on a screen as shown. A glass slab of thickness *t* is inserted between the lens and the screen. In order for the image to be again sharply focussed, it is necessary to move the screen a small distance *d*

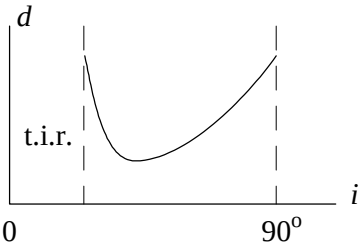
A. away from the lens; *d* decreases when *t* increases.
B. away from the lens; *d* increases when *t* increases.
C. towards the lens; *d* decreases when *t* increases.
D. towards the lens; *d* increases when *t* increases.
E. away from the lens; *d* is independent of *t*.

14.

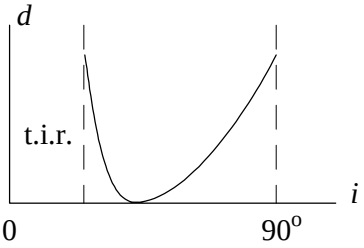


When light is incident on the face *AB* of a prism as shown, it may pass through the face *AC*, with total deviation *d*, or it may suffer total internal reflection at *AC*. Which of the graphs below best represents the variation of *d* with *i*? (t.i.r. represents total internal reflection)

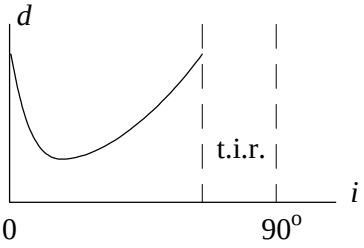
A.



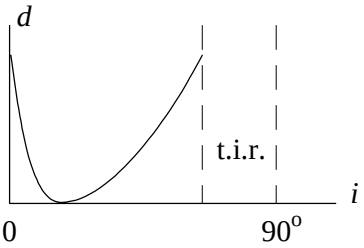
B.



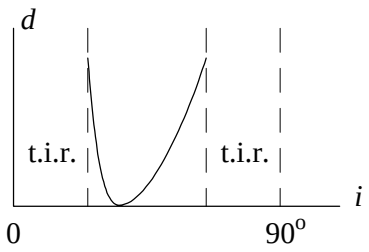
C.



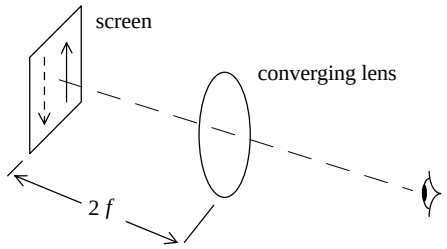
D.



E.

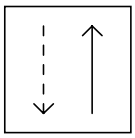


15.

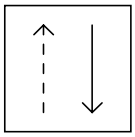


Two arrows are drawn as shown on a screen, placed at a distance 2 *f* from a converging lens of focal length *f*. Which of the following diagrams correctly represents the image seen when the screen is viewed through the lens?

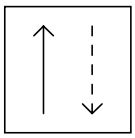
A.



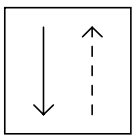
B.



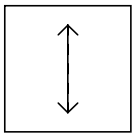
C.



D.

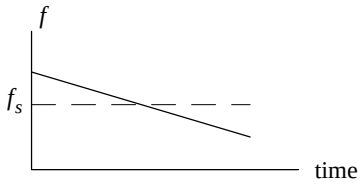


E.

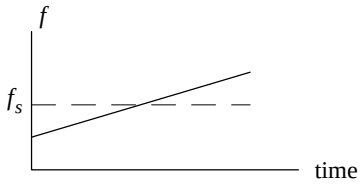


16. An ambulance with its siren sounding a note of constant frequency f_s drives along a straight road. Which of the graphs below best represents the variation of frequency *f* heard by a man standing close to the road as the ambulance drives past?

A.

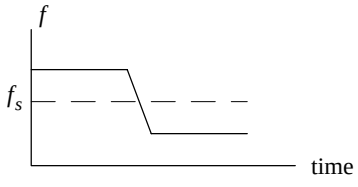


B.

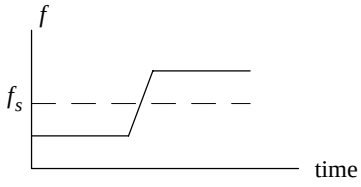


C.

D.



E.



17. A beam of electrons crossing a vacuum tube constitutes a current. Which of the following changes would double the magnitude of the current?

A. Doubling the potential difference across the electron gun which produces the electrons.
B. Halving the area of cross-section of the beam.
C. Halving the length of the tube.
D. Doubling the electron speed.
E. Doubling the electron kinetic energy.

18. Tow parallel wires repel each other with a force F when the same current passes though them. If the current is doubled and the distance between the wires is also doubled, the force of repulsion will then be

A. $F/4$.
B. $F/2$.
C. F.
D. $2F$.
E. $4F$.

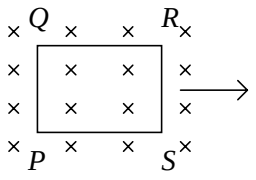
19. A meter has a scale marked -20 μA to +100 μA and its resistance is 24 Ω. In order to convert it to an ammeter with a positive full-scale deflection of +1.0 mA, it is necessary to add a resistance R

A. in parallel, R = 2.4 Ω
B. in series, R = 2.7 Ω
C. in parallel, R = 2.7 Ω
D. in series, R = 3.3 Ω
E. in parallel, R = 3.3 Ω

20. Two parallel metal plates are placed horizontally with a separation of 0.05 m. A p.d. of 2.0 kV is connected across the plates. An oil drop with a charge of -1.6×10^{-19} C is observed to remain at rest between the plates. (Assume g = 10 m/s².) The mass of the drop is

A. 4.0×10^{-25} kg.
B. 1.6×10^{-18} kg.
C. 1.6×10^{-16} kg.
D. 6.4×10^{-16} kg.
E. 6.4×10^{-14} kg.

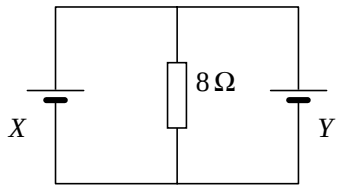
21. A rectangular coil $PQRS$ is driven with constant velocity in a direction perpendicular to a uniform magnetic field as shown.



Which of the following statements is correct?

A. An induced current it flowing in the coil in the clockwise direction.
B. An induced current is flowing in the coil in the anticlockwise direction.
C. An electromagnetic force acts on the side PQ in a direction opposing its motion.
D. There is no induced current flowing in the coil.
E. The magnitude of the magnetic flux through the coil changes with time.

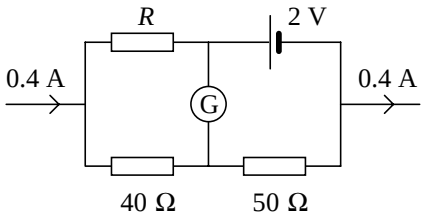
22.



In the above circuit, X and Y are identical cells, of e.m.f. 10 V and internal resistance 4 Ω. What is the current passing through the 8 Ω resistor?

A. zero
B. 5/6 A
C. 1 A
D. 5/3 A
E. 2 A

23.



In the circuit shown, no current flows through the galvanometer G. If the internal resistance of the cell is negligible, what is the value of R?

A. 0.89 Ω
B. 1.3 Ω
C. 4.4 Ω
D. 5.0 Ω
E. 5.3 Ω

24. An alternating current $I = I_0 \sin \omega t$ flows in a coil of inductance L and resistance R. A back e.m.f. E is induced in the coil, where E is equal to

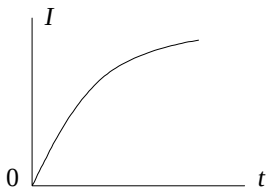
A. $I\omega L$.
B. $L\dfrac{dI}{dt}$.
C. $I(\omega L - R)$.

D. $L\dfrac{dI}{dt} - IR$.

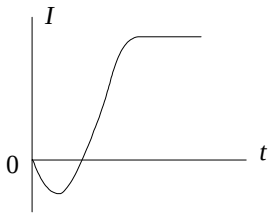
E. $L\dfrac{dI}{dt} + IR$.

25. Which of the following graphs best shows the change of current I with time t when an electric motor connected to a d.c. source is switched on? (The magnetic field is supplied by a permanent magnet.)

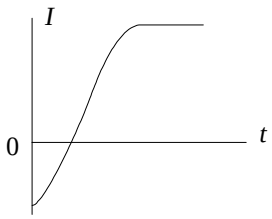
A.



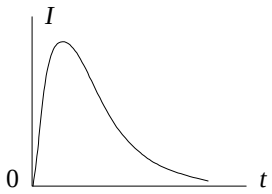
B.



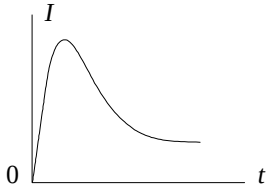
C.



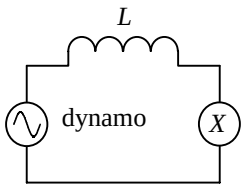
D.



E.



26.



A dynamo is connected to an a.c. ammeter X and a large inductor L as shown. The ammeter reading is I. If the resistance of the circuit is negligible, and the rate of rotation of the dynamo is doubled, the ammeter reads

A. $I/2$.
B. I.
C. $I\sqrt{2}$.
D. $2\,I$.
E. $4\,I$.

27. An alternating voltage V is applied to an LCR series circuit, where the inductive reactance X_L, the capacitive reactance X_C and the resistance R satisfy the relation

$$X_L = 2\,X_C = 2\,R.$$

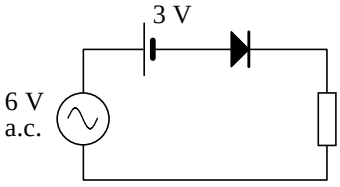
What is the phase difference between V and the potential difference V_C across the capacitor?

A. $\pi/4$
B. $\pi/2$
C. $3\,\pi/4$
D. π
E. $5\,\pi/4$

28. A radioactive source of gamma rays has a half-life of 2 days. A Geiger counter placed 3 m from the source initially has a count-rate of 1440 per minute. After 6 days the counter is moved back to a distance of 9 m from the source, and its count-rate, in counts per minute, is then

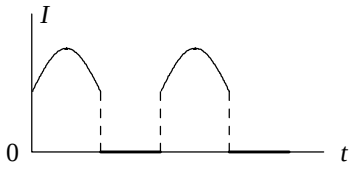
A. 20.
B. 60.
C. 180.
D. 320.
E. 360.

29.

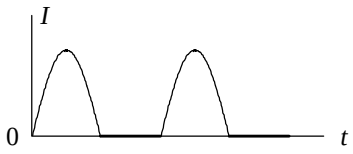


For the circuit shown above, which of the graphs shown below best represents the variation of current I with time t?

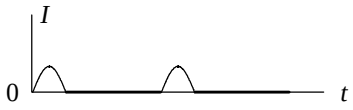
A.



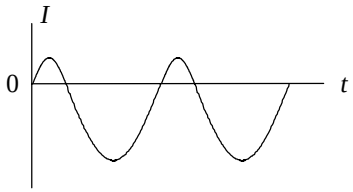
B.



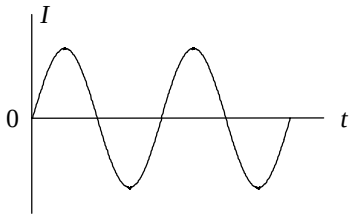
C.



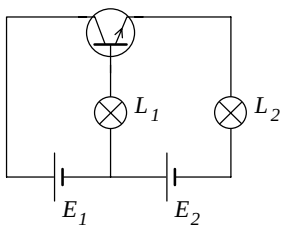
D.



E.



30.



The diagram shows a transistor circuit with two similar light bulbs L_1 and L_2. The bulb L_2 lights up brightly, but L_1 does not glow at all. Which of the following could be a possible reason for this?

A. The filament of L_1 is burnt out.
B. The cell E_1 should be connected the other way round.
C. The cell E_2 should be connected the other way round.
D. The collector current is very much less than the emitter current.
E. The base current is very much less than the emitter current.

31. A wire, of force constant k, has an extension e when it is supporting a weight W. If the elastic limit is not exceeded, the energy stored in the wire is equal to

(1) $\frac{1}{2} \times \text{stress} \times \text{strain}$.
(2) $\frac{1}{2} \times W \times e$.
(3) $\frac{1}{2} \times k \times e^2$.

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

32. A cylinder containing air is fitted with an airtight, frictionless piston maintained at a constant temperature. The piston is moved very slowly inwards, until the volume of the cylinder has halved. Which of the following quantities has doubled?

(1) The average speed of the gas molecules in the cylinder.
(2) The average momentum of the gas molecules in the cylinder.
(3) The average force exerted by the gas molecules on the piston.

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

33. Heat energy must be supplied to a pan of water at 100 °C to keep it boiling. This energy replaces the heat energy lost to the surroundings, and also supplies energy to

(1) increase the average kinetic energy of the molecules.
(2) increase the average potential energy of the molecules.
(3) allow the water vapour to expand against atmospheric pressure.

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

34. Theoretically, the zero on the absolute temperature scale is the point where a fixed mass of an ideal gas has

(1) zero pressure.
(2) zero volume.
(3) infinite density.

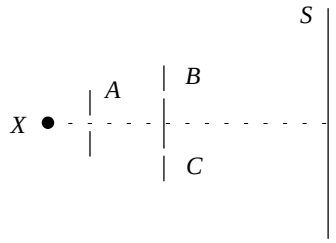
A. (1), (2) and (3)
B. (1) and (2) only
C. (2) and (3) only
D. (1) only
E. (3) only

35. Water has the saturated vapour pressure p at 100 ºC. When a beaker of pure water was heated, it did not start to boil until the temperature was 100.5 ºC. The reason for this could have been

(1) the air above the water was saturated with water vapour.
(2) the external pressure was more than p.
(3) the walls of the vessel were so smooth that bubble formation could not start.

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

36.

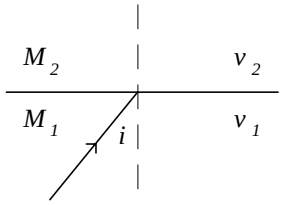


The above arrangement is used in a version of Young's experiment. X is a monochromatic light source. A, B and C are narrow parallel slits. Bright fringes are observed on the screen S. What would happen if the whole set-up were placed in water instead of air?

(1) The central bright fringe will become dark.
(2) The fringes on both sides become multi-coloured.
(3) The separation between the fringes decreases.

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

37.



Light travels in media M_1 and M_2 with speeds v_1 and v_2 respectively. When light travelling from medium M_1 strikes a boundary between the two media with angle of incidence i, it suffers total internal reflection. This indicates that

(1) v_1 is less than v_2.
(2) sin i is less than v_1/v_2.
(3) sin i is greater than v_2/v_1.

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

38. When monochromatic light is incident normally on a wedge-shaped thin film, an interference pattern may be seen by reflection. Which of the following changes would increase the number of fringes per unit length as seen by an observer?

(1) increasing the wavelength of the light
(2) increasing the angle of the wedge
(3) increasing the refractive index of the film material

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

39. In a standing wave in a closed pipe,

(1) some air molecules do not vibrate.
(2) no energy comes out of the pipe.
(3) in the fundamental mode of vibration air molecules in the middle of the pipe oscillate through a larger amplitude than molecules at any other part of the pipe.

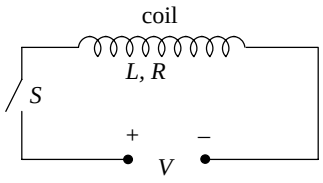
A. (1), (2) and (3)
B. (1) and (2) only
C. (2) and (3) only
D. (1) only
E. (3) only

40. Which of the following statements about the coulomb is/are correct?

(1) When one coulomb of charge flows across a potential difference of one volt, one joule of energy is released.
(2) The force exerted on a charge of 1 coulomb in an electrostatic field of 1 volt/metre is 1 newton.
(3) 1 coulomb is the charge on 1 mole of electrons.

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

41.

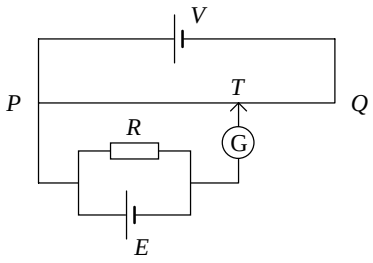


A steady potential difference V is applied across a coil of inductance L and resistance R, connected to a switch S, as shown. After closing the switch S, the current increases and takes time t to reach half its steady maximum value. The time t can be shortened by

(1) inserting a piece of soft iron inside the solenoid.
(2) applying a higher potential difference to the circuit.
(3) adding a resistor in series with the coil.

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

42.



The potentiometer circuit shown is used to find the internal resistance of the cell E. At balance, the galvanometer pointer does not deflect, and NO current flows through

(1) the potentiometer wire PQ.
(2) the resistor R.
(3) the galvanometer G.

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

43. A 10 V, 5 W light bulb in a set of Christmas tree lights (which consists of 20 bulbs in series) burns out and Jimmy goes to buy a replacement. When he gets back, he finds that although the new bulb is marked 5 W, the light it gives is very dim, although the other bulbs light up brightly. Which of the following is a possible reason for this?

(1) The supply voltage has dropped below 200 V.
(2) The current through the circuit is very much less than 0.5 A.
(3) The bulb is designed to work at a voltage higher than 10 V.

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

44. A signal is applied to the Y plates of an oscilloscope, with the time base running. the trace on the screen is as shown in Figure (i).

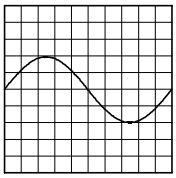


Figure (i)

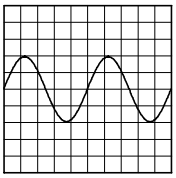


Figure (ii)

Which of the following adjustments would change the trace to that shown in Figure (ii)?

(1) Doubling the *Y* sensitivity.
(2) Doubling the sweep speed of the time base.
(3) Doubling the frequency of the signal.

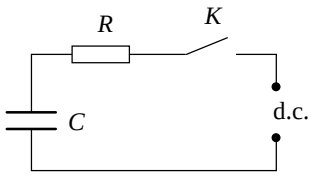
A. (1), (2) and (3)
B. (1) and (2) only
C. (2) and (3) only
D. (1) only
E. (3) only

45. The resonant frequency of a series *LCR* circuit is f_0. When an alternating signal *V* of frequency *f* is applied to this circuit, a current *I* flows in it. Which of the following is/are correct?

(1) There is no phase difference between *I* and *V* when $f = f_0$.
(2) *I* leads *V* when *f* is very much less than f_0.
(3) *V* leads *I* when *f* is very much greater than f_0.

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

46.



A capacitor and a resistor are connected in series to a d.c. voltage supply as shown. At time $t = 0$, the key *K* is closed. Which of the following statements is/are true?

(1) At any time *t* the sum of the potential differences across *C* and *R* is a constant.
(2) The capacitor is almost fully charged after a time $t = 5\,CR$.
(3) The final charge on the capacitor does not depend on the position of *R* in the circuit.

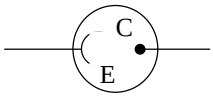
A. (1), (2) and (3)
B. (1) and (2) only
C. (2) and (3) only
D. (1) only
E. (3) only

47. The allowed energy levels for an atom are $E_n = -W/n^2$, where *W* is a constant and *n* is any positive integer. The frequency of a photon corresponding to the energy transition from $n = m + 1$ to $n = m$

(1) is directly proportional to *W*.
(2) decreases as *m* increases.
(3) increases as the temperature increases.

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

48.

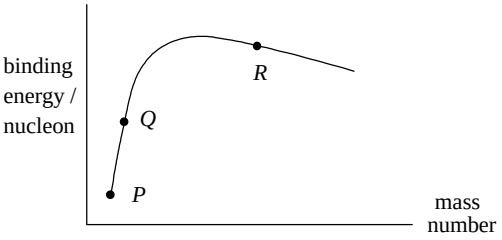


The above figure shows a photoelectric cell. *E* is the emitter and *C* is the collector. The stopping potential for photoelectrons depends on

(1) the nature of *E*.
(2) the distance between *E* and *C*.
(3) the surface area of *E*.

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

49. The binding energy per nucleon varies with mass number as shown below:



If nuclear energy were to be generated by the fusion of the nuclei of an element *X*, which of the points *P*, *Q* and *R* would represent possible positions of *X* on the graph?

(1) *P*
(2) *Q*
(3) *R*

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

50. When alpha particles are fired in a beam at a thin sheet of gold, they are scattered though a wide range of angles, from zero to 180º from the incident beam. This experiment shows that they gold atom has

(1) electrons in different orbits.
(2) a volume consisting mainly of empty space.
(3) a small, dense, charged nucleus.

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

- End of Paper -

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