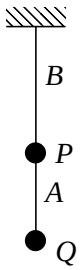
1985 Hong Kong Advanced Level Examination
AL Physics
Multiple Choice Question

1.



Two bodies *P* and *Q* are connected by a light string *A*. The weights of *P* and *Q* are 4 N and 10 N respectively. *P* is connected to the roof by another light string *B*. If string *B* is cut and the bodies allowed to fall, the net force acting on *P* during free fall is

A. 0 N.
B. 4 N.
C. 6 N.
D. 10 N.
E. 14 N.

2. A lift of mass *M* carries a man of mass *m*. When the lift is being hauled upward by a rope, the lift rises with an acceleration *a*. The reaction between the man and the floor of the lift is

A. mg.
B. $m(g - a)$.
C. $m(g + a)$.
D. $m(g + a) - Ma$.
E. $m(g + a) + Ma$.

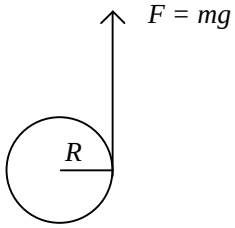
3. A motorcyclist going round a corner on a level road leans over at an angle to the horizontal. The reason for this is

A. to allow his weight to exert a torque about the contact point on the ground.
B. to increase the frictional force between the motorcycle and the road.
C. to lower his centre of mass.
D. to provide the centripetal force.
E. to reduce the radius of curvature of his path.

4. Which of the following statements is true of the acceleration of a particle oscillating with S.H.M.?

A. It is always in the opposite sense to the velocity of the particle.
B. It varies linearly with the frequency of oscillation.
C. It has its smallest magnitude when the speed of the particle is greatest.
D. It decreases as the potential energy increases.
E. Its magnitude is a minimum when the displacement of the particle is a maximum.

5.



A string wraps around a uniform cylinder of radius *R* and mass *m*. A constant tension $F = mg$ is maintained in the string causing the cylinder to rotate about its cylindrical axis. Given that the moment of inertia of the cylinder about its axis is $mR^2/2$, the angular acceleration of the cylinder is

A. 0.
B. gR.
C. $g/(2R)$.
D. g/R.
E. $2\,g/R$.

6. If v_1 is the minimum speed for a projectile to escape from the earth and v_2 is the orbital speed of a satellite circling close to the earth, then v_1/v_2 =

A. $1/\sqrt{2}$.
B. 1/2.
C. 1.
D. $\sqrt{2}$.
E. 2.

7. One end of a capillary tube of length 10 cm is dipped into water. The water level rises by 5 cm inside the tube. if the capillary tube is now taken out and reinserted into the water so that only 4 cm of the tube is above the water surface,

A. the water inside the tube will not rise.
B. the water inside the tube will rise to the 2 cm level.
C. the water inside the tube will rise to the 4 cm level.
D. the water will flow out of the tube continuously.
E. the water will shoot up to a height of 5 cm.

8. A liquid of density 1.00×10^3 kg/m³ flows along a horizontal pipe whose cross-sectional area changes from 50×10^{-6} m² to 25×10^{-6} m². Manometers (using the same liquid) are attached to the two sections of the pipe and the vertical difference between the levels of liquid in them is 50 mm. The rate of flow of the liquid mass in the pipe must be

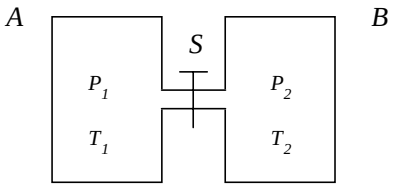
A. 0.22×10^{-2} kg/s.
B. 1.44×10^{-2} kg/s.
C. 2.50×10^{-2} kg/s.
D. 2.89×10^{-2} kg/s.
E. 5.01×10^{-2} kg/s.

(g may be taken to be 10 m/s².)

9. In a bromine diffusion experiment, liquid bromine is introduced into the bottom of a glass column containing air. Diffusion of bromine occurs and the 'half-brown' level reaches a distance d from the bottom of the column after time t. If the r.m.s. speed of bromine molecules is c, then the mean free path of the molecules is

A. ct.
B. $d^2 / (ct)$.
C. $c^2 t^2 / d$.
D. $\sqrt{(cdt)}$.
E. $d / \sqrt{(ct)}$.

10.



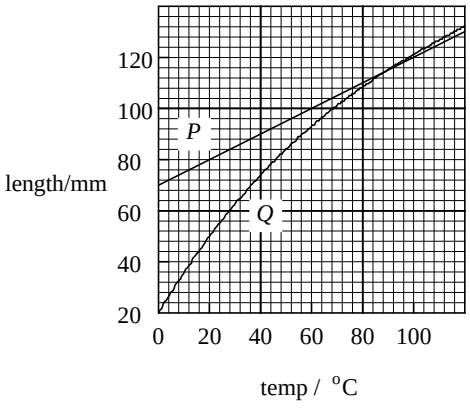
A and B are two identical containers connected by a tap S initially closed. A contains an ideal gas at a pressure P_1 and a temperature T_1. B contains the same gas at a pressure P_2 and a temperature T_2. The tap S is then opened. If the temperatures of the containers A and B remain constant at T_1 and T_2 respectively, the final pressure of the gas mixture will be

A. $(P_1 + P_2)/2$.
B. $(P_1 + P_2)$.
C. $(P_1T_1 + P_2T_2) / (T_1 + T_2)$.
D. $(P_1T_2 + P_2T_1) / (T_1 + T_2)$.
E. $(\frac{P_1}{T_1} + \frac{P_2}{T_2})(T_1 + T_2)$.

11. A vessel of volume 1×10^{-3} m³ contains 0.72 g of an ideal gas at a pressure of 1×10^5 Pa. The r.m.s. velocity of the gas molecules is

A. 20 m/s.
B. 110 m/s.
C. 340 m/s.
D. 650 m/s.
E. 3400 m/s.

12.



The graph shows the variations of the lengths of the liquid columns of two liquid-in-glass thermometers with the temperature being measured on the ideal gas scale. What are the Celsius temperatures obtained with these liquid-in-glass scales which correspond to 60 ºC on the ideal gas scale?

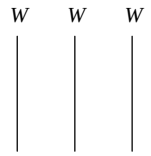
	Thermometer *P*	Thermometer *Q*
A.	50 ºC	60 ºC
B.	60 ºC	60 ºC
C.	60 ºC	70 ºC
D.	70 ºC	60 ºC
E.	100 ºC	90 ºC

13. External work W is done on a real gas and no heat energy is allowed to enter or leave the gas. If the change in internal energy of the gas is ΔU, then

A. $\Delta U = 0$.
B. $0 < \Delta U < W$.
C. $\Delta U = W$.
D. $W < \Delta U < 2\,W$.
E. $\Delta U = 2\,W$.

14. White light is directed normally onto a diffraction grating and the diffracted light is observed through the telescope of a spectrometer. The appearance of the zeroth order and the first order diffraction pattern will look like:

A.



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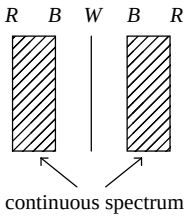

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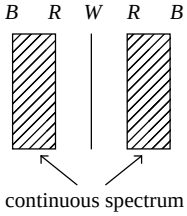

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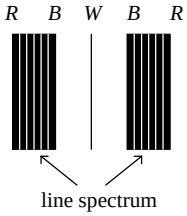
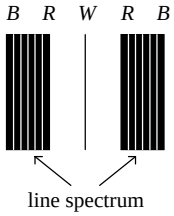
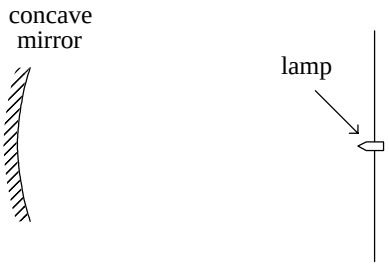


E.



(W : white, R : red, B : blue)

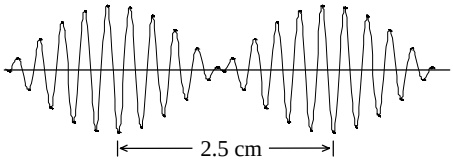
15.



The diagram above shows a small electric lamp fixed on a wall and positioned on the principal axis of a concave mirror of radius of curvature 12 cm. If the mirror is 24 cm from the wall, which of the following statements best describes the appearance of the reflected light on the wall?

A. It is the form of a dot on the lamp.
B. It is a circular patch on the lamp and the same size as the lamp.
C. It is a circular patch round the lamp but smaller in size than the mirror.
D. It is a circular patch round the lamp and the same size as the mirror.
E. It is a circular patch round the lamp but larger in size than the mirror.

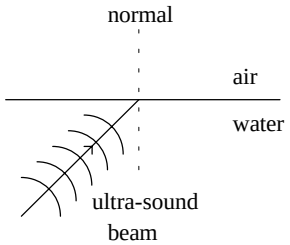
16. Two signal generators are connected to display the formation of beats on a C.R.O. screen. For one particular setting of the two signal generators, the following pattern is observed on the C.R.O.:



If the C.R.O. time base is set at 0.2 ms/cm, the beat frequency is

A. 100 Hz.
B. 200 Hz.
C. 400 Hz.
D. 1 000 Hz.
E. 2 000 Hz.

17.



A beam of ultrasound is being emitted from a submarine under water towards the water surface. Which of the following statements is true?

A. The refracted beam leaving the surface will bend away from the normal.
B. The refracted beam will bend towards the normal.
C. The refracted beam will travel in the same direction as the incident beam.
D. Total internal reflection will occur.
E. The refracted beam will travel along the water surface.

18. The surface of a material of refractive index 1.8 is coated with a thin film of liquid of refractive index 1.5 and thickness 200 nm. White light falls normally on the thin film. Which of the following light wavelengths (in air) is not reflected from the thin film?

A. 400 nm
B. 450 nm
C. 600 nm
D. 750 nm
E. 800 nm

19. The image of a distant star produced by an astronomical telescope is a diffraction pattern. If the effective diameter of the objective lens is reduced by one-half by covering its outer parts with a stop, the area of the central maximum of the diffraction pattern is

A. decreased by a factor of 4.
B. halved.
C. unchanged.
D. doubled.
E. increased by a factor of 4.

20. When parallel light is incident at the Brewster angle in air on the surface of a glass block,

A. the light is totally reflected.
B. the reflected light is partially polarised.
C. the transmitted light is unpolarised.
D. the reflected and refracted wavefronts are at right angles to each other.
E. the angle of incidence is equal to the angle of refraction.

21. A photograph is taken with a camera. The exposure time required with an aperture of *f*-4 is 1 s. The exposure time required with an aperture of *f*-8 is

A. 0.25 s.
B. 0.50 s.
C. 1 s.
D. 2 s.
E. 4 s.

22. Which of these statements concerning electric potential is INCORRECT?

A. Potential is a scalar quantity.
B. The potential difference between two points, expressed in volts, is numerically equal to the change in the energy, expressed in joules, when a coulomb of charge is moved from one point to the other.

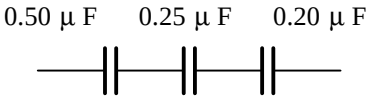
C. The potential is zero whether the electric field is zero.
D. The potential due to a point charge varies as $1/r$, where r is the distance from the point charge.
E. The potential gradient at a point is proportional to the strength of the electric field at that point.

23. The energy of a 2 μF capacitor when charged to a potential difference V is E. The energy of a 4 μF capacitor when charged to a potential difference 3 V is

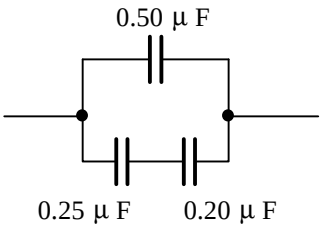
A. 3 E.
B. 6 E.
C. 9 E.
D. 12 E.
E. 18 E.

24. Which one of the following combinations has the least capacitance?

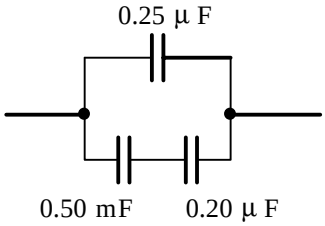
A.



B.



C.



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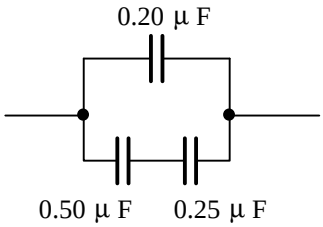
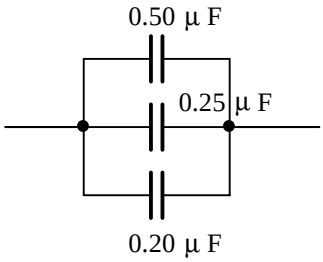
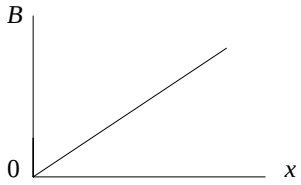


E.

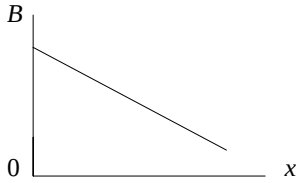


25. Which of the following graphs best represents the variation of the magnetic flux density B along the axis of a long current-carrying solenoid, with the distance x from the centre of the solenoid along the axis?

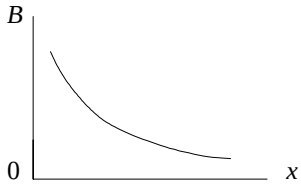
A.



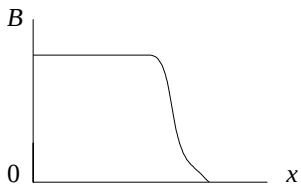
B.



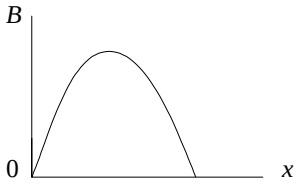
C.



D.



E.



26. An ammeter is connected in series with an electric motor which is running freely, and the reading noted. When the motor raises a load at a steady speed, the reading of the ammeter will

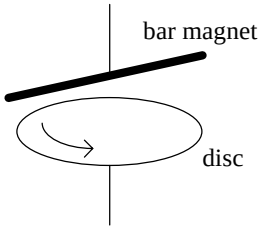
A. remain the same.
B. increase to a higher value.
C. decrease to a lower value.
D. increase to a maximum value and then decrease.
E. decrease to a minimum value and then increase.

27.

A particle, of mass 3.2×10^{-26} kg and charge -1.6×10^{-19} C, enters a uniform magnetic field of flux density 0.08 T at a speed of 10^5 m/s, as shown. It will

A. pass undeviated through the magnetic field.
B. be deflected upward in a circular arc of radius 0.25 m.
C. be deflected upward in a circular arc of radius 0.50 m.
D. be deflected downward in a circular arc of radius 0.25 m.
E. be deflected downward in a circular are of radius 0.50 m.

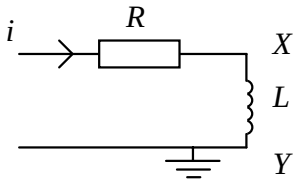
28.



A bar magnet is freely suspended so that it hangs horizontally above a flat aluminium disc which is rotating in a horizontal plane. The bar magnet will

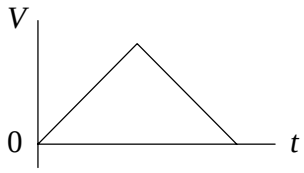
A. rotate in the same direction as the disc.
B. rotate in the opposite direction to the disc.
C. remain at rest.
D. oscillate to and fro in the horizontal plane.
E. oscillate to and fro in the vertical plane.

29.



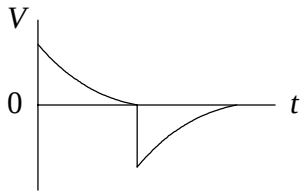
L is a pure inductor, in series with a resistor *R*. The current *i* in the circuit is initially zero at time $t = 0$ and afterwards it rises linearly to reach a maximum at $t = T$; it then falls linearly to zero in the same time. Which of the following waveforms represents the variation of the potential *V* at point *X* with respect to time *t*?

A.

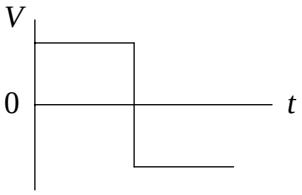


B.

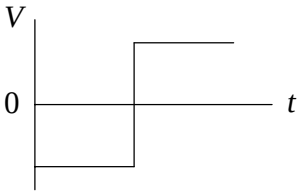
C.



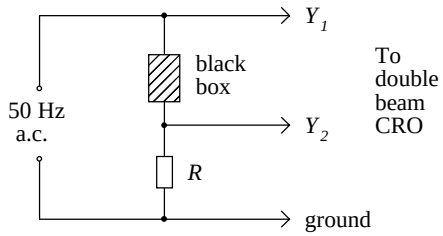
D.



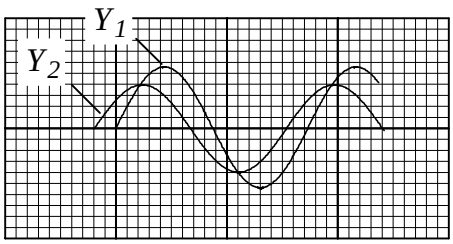
E.



30. A black box, known to contain an electrical device, is connected in series with a resistor *R*. The following circuit is set up:



The pattern observed on the double beam C.R.O. is shown below:



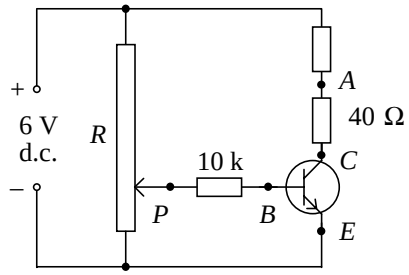
The electrical device inside the box is

A. a capacitor.
B. a diode.
C. an inductor.
D. a resistor.
E. a transistor.

31. Protactinium extracted from a solution of uranyl nitrate decays with a half-life of 72 s. The value of the decay constant is

A. 9.6×10^{-3} s.
B. 9.6×10^{-3} s^{-1}.
C. 0.014 s^{-1}.
D. 49.9 s.
E. 49.9 s^{-1}.

32.



In the transistor circuit shown above, the voltages V_{AE}, V_{PE}, V_{CE} and V_{BE} were measured and tabulated as follows:

V_{AE}	V_{PE}	V_{CE}	V_{BE}
3.6 V	2.6 V	2.5 V	0.6 V

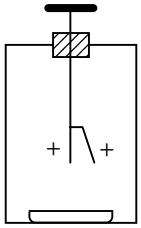
What are the values for the base current I_B and the collector current I_C?

	I_B/mA	I_C/mA
A.	0.2	7.8
B.	0.2	27.5
C.	0.26	7.8
D.	0.26	27.5
E.	0.68	34.0

33. In a gold-foil scattering experiment, an α-particle and a proton, having the same kinetic energy, collide head-on with gold-nuclei. The ratio of the distance of closest approach of the α-particle to that of the proton is

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

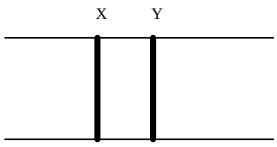
34.



A dish containing a strong α-source is placed inside a gold leaf electroscope containing dry air. If the gold-leaf is originally positively charged, what will happen to if after a few minutes?

A. It will increases in divergence.
B. It will increases in divergence and then decrease.
C. It will collapse.
D. It will collapse and then rediverge.
E. There will be no change in divergence.

35.



The figure above shows two adjacent lines in the spectrum of a hot gas. Line *X* is brighter than line *Y* because

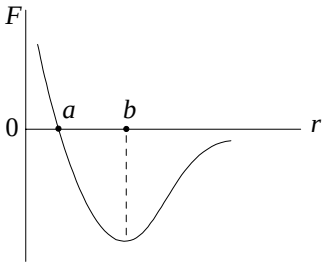
A. line *X* has a higher frequency.
B. line *X* has a greater wavelength.
C. line *X* originates in the hotter part of the gas.
D. for line *X*, more electrons undergo transitions between the two states involved in the emission.
E. for line *X*, electrons undergo transitions between two states of greater energy difference.

36. Which of the following pairs of quantities have the same dimensions?

(1) pressure and Young modulus
(2) angular momentum and Planck constant
(3) coefficient of viscosity and gravitational constant

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

37.



The graph shows how the force *F* between two atoms in a solid varies with the distance *r* between them. Which of the following statements about the distances *a* and *b* marked on the graph is/are correct?

(1) *a* is the smallest possible separation of the atoms.
(2) *b* is the equilibrium separation of the two atoms.
(3) The stiffness of the solid depends on the slope of the curve near *a*.

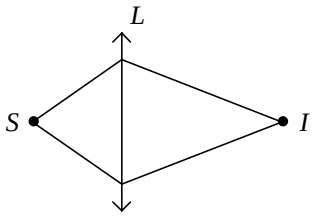
A. (1), (2) and (3)
B. (1) and (2) only
C. (2) and (3) only
D. (1) only
E. (3) only

38. According to the kinetic theory of gases, at a given temperature, the molecules of all gases have the same

(1) average speed.
(2) average kinetic energy.
(3) average intermolecular potential energy.

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

39.



A converging lens L and a lamp S are arranged as shown. The rays from S converge at a point I after passing through L. Which of the following operations could enable a parallel beam of light to emerge from the lens L?

(1) moving the lens L to the left until parallel rays are obtained
(2) replacing L by a lens with less converging power
(3) placing a diverging lens of suitable focal length in front of the lens L

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

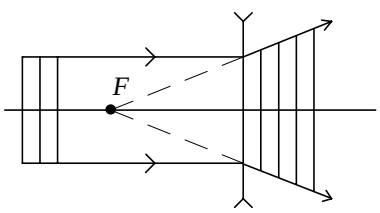
40. In a compound microscope,

(1) the final image produced is virtual.
(2) the final image produced is erect.
(3) the focal lengths of both the objective and the eyepiece must be long in order to produce high magnification.

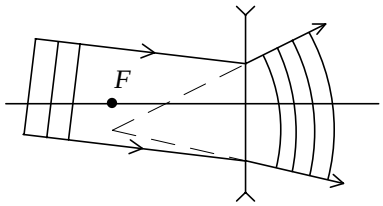
A. (1), (2) and (3)
B. (1) and (2) only
C. (2) and (3) only
D. (1) only
E. (3) only

41. A train of plane wavefronts is incident upon a diverging lens. F denotes one of the focal points of the lens. Which of the following diagrams represent(s) what might happen to the wavefronts?

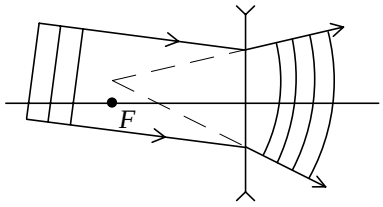
(1)



(2)



(3)



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

42. A sound source S approaches an observer O at a constant speed v. Which of the following statements is/are correct?

(1) The frequency of the source as heard by O increases linearly with time as S approaches O.
(2) The sound appears louder and louder as S approaches O.
(3) The wavelength of the wave appears to be shorter as S approaches O.

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

43.

A charged capacitor C_1 is connected to an uncharged capacitor C_2 as shown. If

E_1 = the total enrgy stored in C_1 and C_2 before connection, and

E_2 = the total energy stored in C_1 and C_2 after connected,

which of the follwoing is/are correct?

(1) $E_1 = E_2$.
(2) After connection, the p.d. across C_1 is equal to the p.d. across C_2.
(3) After connection, the charges stored in C_1 and C_2 are in the ratio

$$\frac{\text{capacitance of } C_1}{\text{capacitance of } C_2}.$$

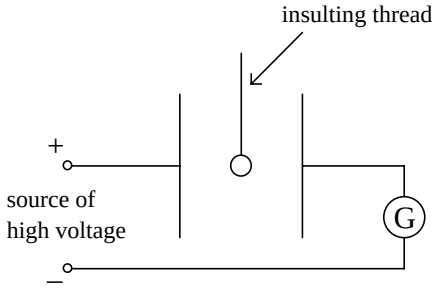
A. (1), (2) and (3)
B. (1) and (2) only
C. (2) and (3) only
D. (1) only
E. (3) only

44. The e.m.f. of a battery is equal to

(1) the total electrical power it generates divided by the current it delivers.
(2) the total electrical energy it releases, per coulomb of charge when connected to an external circuit.
(3) the potential difference across its terminals when it is on open circuit.

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

45.

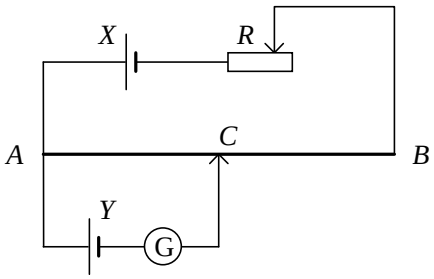


A conducting ball is suspended between two metal plates connected through a sensitive centre-zero galvanometer to a source of high p.d. The ball shuttles back and forth between the plates, making alternate contacts with each plate. Which of the following statements is/are correct?

(1) The ball carries charges, sometimes positive, and sometimes negative,
(2) If the separation of the metal plates decreases, the frequency of oscillation of the ball increases.
(3) The galvanometer shows a current flowing always in the same direction.

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

46.



In the above circuit, C denotes the balance position on the potentiometer wire AB. Which of the following procedures can shift C towards the end B?

(1) replacing the driving cell X by one with a larger e.m.f.
(2) adding a resistance in series with the galvanometer G.
(3) increasing the resistance of the rheostat R.

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

47. The ionisation potential of a hydrogen atom is 13.6 V. Which of the following energy levels is/are possible for the atom?

(1) - 1.51 eV
(2) - 3.40 eV
(3) - 6.80 eV

A. (1), (2) and (3)

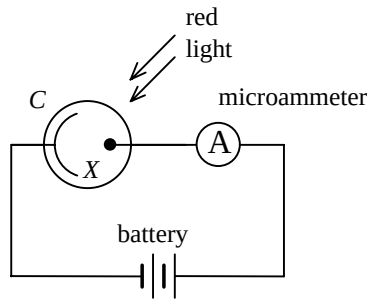
B. (1) and (2) only
C. (2) and (3) only
D. (1) only
E. (3) only

48. The photons emitted by a laser

(1) are of same frequency.
(2) travel in the same direction.
(3) are in phase.

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

49.



Red light shines on the photoelectric cell *C* as shown. If the reading of the microammeter is zero, this may be explained by the fact that

(1) the e.m.f. of the battery is too small.
(2) the intensity of the light is too low.
(3) electrode *X* is made of a material with too great a work function.

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

50. Which of the following phenomena can provide direct evidence for the existence of discrete electron energy levels in atoms?

(1) electron diffraction
(2) photo-electric emission
(3) the spectrum of light from a sodium lamp

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.	C	27.	D
3.	A	28.	A
4.	C	29.	D
5.	E	30.	A
6.	D	31.	B
7.	C	32.	B
8.	D	33.	D
9.	B	34.	C
10.	D	35.	D
11.	D	36.	B
12.	C	37.	E
13.	C	38.	C
14.	B	39.	A
15.	E	40.	D
16.	E	41.	E
17.	B	42.	C
18.	A	43.	C
19.	E	44.	A
20.	D	45.	A
21.	E	46.	E
22.	C	47.	B
23.	E	48.	A
24.	A	49.	E
25.	D	50.	E