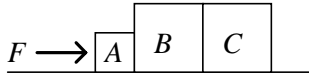


**1992 Hong Kong Advanced Level Examination**  
**AL Physics**  
**Multiple Choice Question**

1.



Three blocks  $A$ ,  $B$  and  $C$  of masses  $m$ ,  $2m$  and  $2m$  respectively are placed on a smooth horizontal ground as shown in the figure above. A constant horizontal force is applied to block  $A$  so that the three blocks move with the same acceleration towards the right. What is the resultant force acting on block  $B$ ?

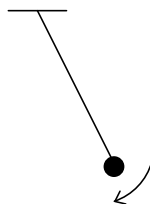
- A.  $F/5$
- B.  $F/3$
- C.  $2F/5$
- D.  $3F/5$
- E.  $F$

2. A man in a lift measures his weight with a compression balance and discovers that his weight is reduced by 10%. The lift is probably

- (1) moving upwards and accelerating at  $g/10$ .
- (2) moving upwards and decelerating at  $g/10$ .
- (3) moving downwards and accelerating at  $g/10$ .
- (4) moving downwards and decelerating at  $g/10$ .
- (5) moving downwards with uniform velocity.

- A. (1) and (3) only
- B. (1) and (4) only
- C. (2) and (3) only
- D. (2) and (4) only
- E. (5) only

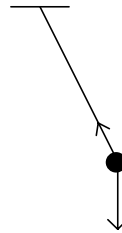
3.



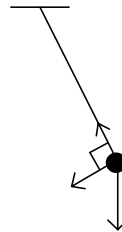
A simple pendulum is swinging in a vertical plane. When it is at the position shown, which

of the following diagrams best represents the forces acting on the bob? Neglect air friction.

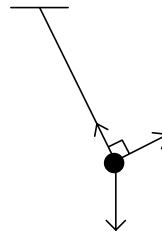
A.



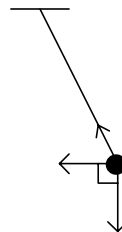
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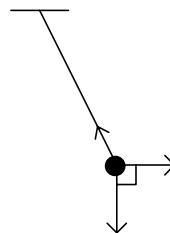
C.



D.



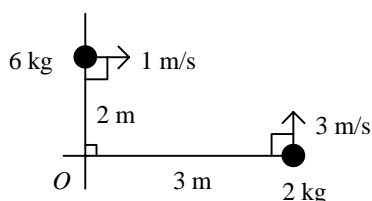
E.



4. An object is placed on a horizontal platform vibrating vertically in S.H.M. with a period of 0.2 s. The maximum amplitude of oscillation which will allow the object to remain in contact with the platform throughout the motion is
- 1 cm
  - 5 cm
  - 10 cm
  - 100 cm
  - indeterminate

5. An object of mass  $m$  is released from a spacecraft at a distance  $3R$  from the centre of the Earth which has radius  $R$  and mass  $M$ . On reaching the Earth's surface, the increase in kinetic energy of the object is
- $GmM/(3R)$
  - $2GmM/(3R)$
  - $GmM/(2R)$
  - $GmM/R$
  - $2GmM/R$

6.



Two objects are moving with instantaneous velocities as shown in the above diagram. The total angular momentum about the point  $O$  at this instant is

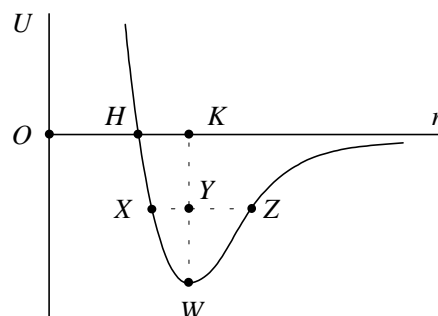
- $4 \text{ kg m}^2 \text{ s}^{-1}$
  - $6 \text{ kg m}^2 \text{ s}^{-1}$
  - $10 \text{ kg m}^2 \text{ s}^{-1}$
  - $20 \text{ kg m}^2 \text{ s}^{-1}$
  - $30 \text{ kg m}^2 \text{ s}^{-1}$
7. A gymnast on a trampoline is performing a somersault and draws his knees to his chest. Which of the following quantities (about a horizontal axis through his centre of mass) will be increased?

(1) His angular momentum.

- (2) His moment of inertia.  
 (3) His rotation speed.

- (1), (2) and (3)
- (1) and (2) only
- (2) and (3) only
- (1) only
- (3) only

8.



The diagram above shows the variation of the potential energy  $U$  between neighbouring atoms in a solid with the separation  $r$  between them. Which of the following features of the curves best explains why the solid expands on heating?

- $OH > HK$
- $OH > XZ$
- $KY > YW$
- $HK > XY$
- $YZ > XY$

9. The radius of a soap bubble is  $r$ . If the atmospheric pressure is  $P$ , and the surface tension of the soap solution is  $T$ , then the pressure inside the soap bubble is

- $P - 4T/r$
- $P - 2T/r$
- $P$
- $P + 2T/r$
- $P + 4T/r$

10. A flat plate of area  $0.1 \text{ m}^2$  is placed on a flat surface, and is separated from it by a film of oil  $10^{-5} \text{ m}$  thick. If the coefficient of viscosity of oil is  $1.8 \text{ N s m}^{-2}$ , the force required to cause the plate to slide on the surface at a constant speed of  $1 \text{ cm/s}$  is

- A. 1.8 N  
 B. 18 N  
 C. 180 N  
 D. 1800 N  
 E. 18000 N

11. A ball-bearing is dropped into viscous oil. Which of the following correctly describes its motion before the terminal speed is reached?

<u>Velocity</u>	<u>Acceleration</u>
-----------------	---------------------

- |              |           |
|--------------|-----------|
| A. decreases | decreases |
| B. decreases | increases |
| C. increases | constant  |
| D. increases | decreases |
| E. increases | increases |

12. A ductile fracture occurs

- (1) after appreciable plastic deformation, by slow crack propagation.  
 (2) when dislocations are not free to move.  
 (3) after a brittle fracture occurs.

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

13. Given: Avogadro constant =  $6 \times 10^{23} \text{ mol}^{-1}$   
 Boltzmann constant =  $1.38 \times 10^{-23} \text{ J/K}$   
 Molar gas constant =  $8.31 \text{ J mol}^{-1} \text{ K}^{-1}$

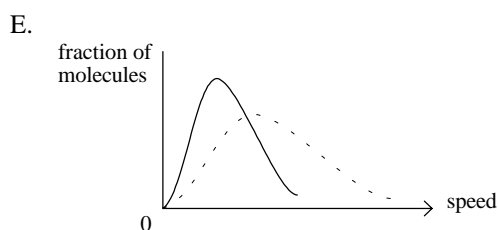
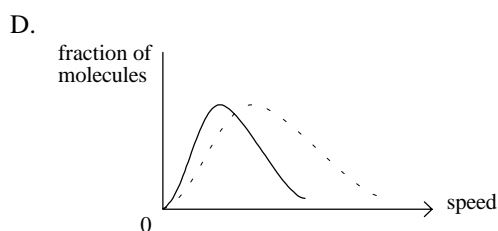
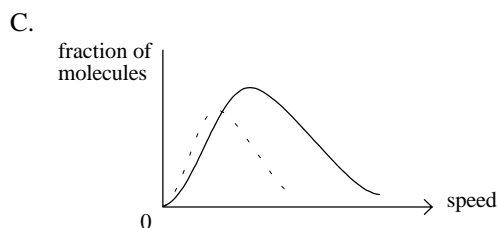
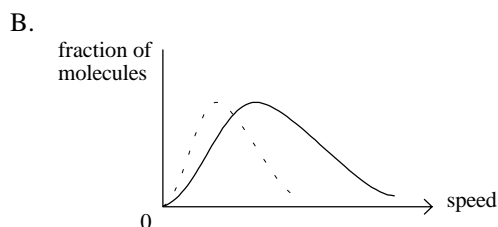
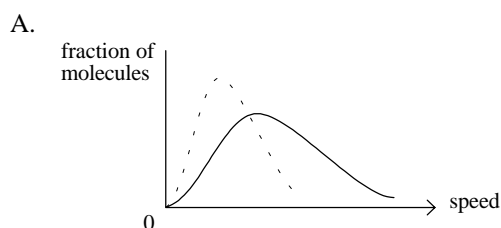
If 1 mole of an ideal gas is heated under constant pressure from 20 °C to 70 °C, the total kinetic energy of the gas molecules is increased by

- A. 208 J  
 B. 415 J  
 C. 581 J  
 D. 623 J  
 E. 831 J

14. The relative atomic mass of oxygen is 16. What is the ratio of the average speed of oxygen molecules to that of hydrogen molecules at room temperature?

- A. 1/16  
 B. 1/4  
 C. 1  
 D. 4  
 E. 16

15. Which of the graphs best represents the distribution of molecular speeds in a gas at 500 K if the dotted curve represents this distribution for the same gas at 300 K?



16. The image of an object formed on a screen by a convex lens has height  $a$ . By moving the lens towards the screen, it is found that there is a second lens position at which another image of height  $b$  is formed on the screen. The height of the object is
- $(a + b)/2$
  - $\sqrt{(a^2 + b^2)}$
  - $\sqrt{ab}$
  - $\sqrt{(a^3/b)}$
  - $\sqrt{(b^3/a)}$

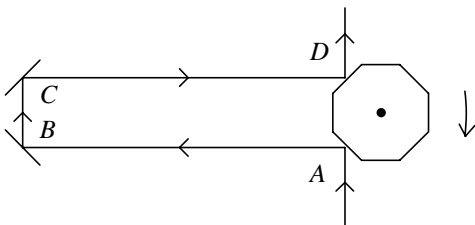
17. The sun subtends an angle of  $0.5^\circ$  at the surface of the Earth. A convex lens of focal length 100 cm is used to form an image of the sun onto a screen. The diameter of the image is about
- 1 mm
  - 3 mm
  - 5 mm
  - 9 mm
  - 50 mm

18. In an astronomical telescope set at normal adjustment, the focal lengths of the objective and the eyepiece are 50 cm and 10 cm respectively. Which of the following gives the separation of the lenses and the angular magnification of the telescope?

Lens separation      Angular magnification

- 30 cm                      5
- 40 cm                      0.5
- 40 cm                      5
- 60 cm                      0.5
- 60 cm                      5

19.



Light is incident on an octagonal mirror and traverses a path  $ABCD$ , of total length  $L$ , before being reflected again from another face of the octagonal mirror. The octagonal mirror is rotated and its angular velocity adjusted until

the light emerges in the same direction as when the mirror is stationary. If the speed of light is  $c$ , the smallest angular velocity to achieve this condition is

- $\pi c/(8L)$
- $\pi c/(4L)$
- $\pi c/(2L)$
- $\pi c/L$
- $2\pi c/L$

20.

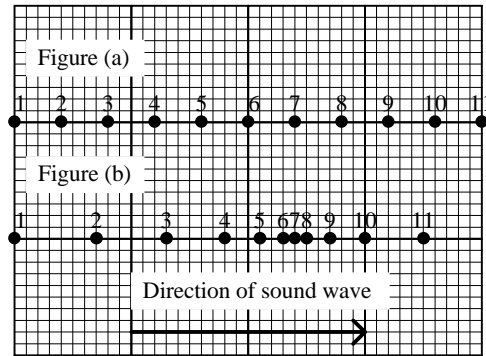


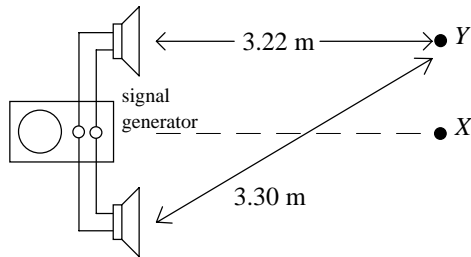
Figure (a) shows the positions of equally spaced molecules in a solid lattice. A longitudinal sound wave travels from left to right through the solid. At a certain instant, the displaced positions of the molecules are shown in Figure (b). Immediately afterwards, what will be the directions of motion of particle 1 and particle 7?

- |    | <u>Particle 1</u> | <u>Particle 7</u> |
|----|-------------------|-------------------|
| A. | to the right      | to the right      |
| B. | to the right      | to the left       |
| C. | to the left       | to the right      |
| D. | to the left       | to the left       |
| E. | at rest           | at rest           |

21. A loudspeaker produces a sound intensity level of 80 dB at a point  $P$ . If the electrical power to the loudspeaker is halved, the intensity level at  $P$  will be

- 20 dB
- 30 dB
- 40 dB
- 50 dB
- 77 dB

22.

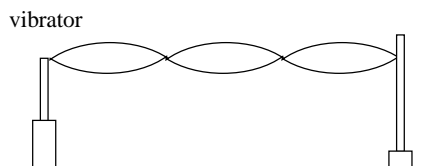


Two loudspeakers are connected to the same signal generator. A microphone positioned at  $X$  detects maximum intensity. When the microphone is moved upwards, maximum intensity is also detected at  $Y$ . Which of the following may give possible values of the wavelength of the sound emitted from the loudspeakers?

- (1) 0.04 m  
 (2) 0.08 m  
 (3) 0.16 m

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

23.



Stationary wave patterns can be produced on an elastic string using the experimental set-up shown above by adjusting the frequency  $f$  of the vibrator. Which of the following statements concerning the experiment is/are correct?

- (1) Stationary wave patterns can be observed for more than one value of the frequency  $f$ .  
 (2) When the frequency  $f$  increases, the number of loops for the stationary wave pattern to be observed also increases.  
 (3) For a stationary wave pattern to occur, the length of the string must be equal to an integral number of wavelengths.

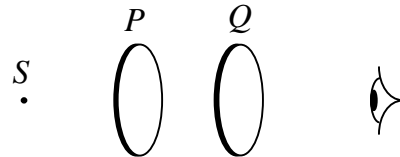
- A. (1), (2) and (3)  
 B. (1) and (2) only  
 C. (2) and (3) only

- D. (1) only  
 E. (3) only

24. When unpolarised light travelling in air falls on the surface of a glass block, it is possible to find an angle of incidence such that

- A. none of the light is reflected.  
 B. the reflected light and the transmitted light are both plane polarised.  
 C. all the light is reflected.  
 D. the transmitted light is plane polarised.  
 E. the reflected light is plane polarised.

25.

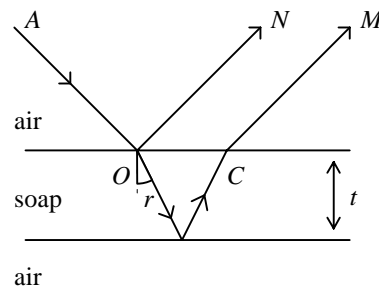


A light source  $S$  is viewed through two parallel pieces of Polaroid  $P$  and  $Q$ .  $Q$  is gradually rotated until the field of view becomes dark. which of the following conclusions can be drawn?

- (1) The experiment shows that light is a transverse wave.  
 (2) The experiment shows that light from source  $S$  must be unpolarised.  
 (3) When  $Q$  is rotated further by  $90^\circ$ , the field of view becomes dark again.

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

26.



A ray  $AO$  of monochromatic light wavelength  $\lambda$  falls on a thin parallel-sided soap film of thickness  $t$  and refractive index  $n$ . Constructive interference will take place between rays  $M$  and  $N$  when

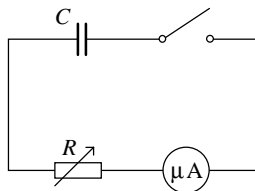
- A.  $nt = m\lambda$
- B.  $nt = (m + \frac{1}{2})\lambda$
- C.  $2nt = m\lambda$
- D.  $2nt \cos r = m\lambda$
- E.  $2nt \cos r = (m + \frac{1}{2})\lambda$

27. How do the two physical quantities below change along the direction indicated by an electric field line from a point positive charge?

- (1) electric field intensity  $E$
- (2) potential  $V$

- A. Only  $E$  will increase
- B. Only  $V$  will increase
- C. Both  $E$  and  $V$  will increase
- D. Both  $E$  and  $V$  will decrease
- E. Both  $E$  and  $V$  will remain constant

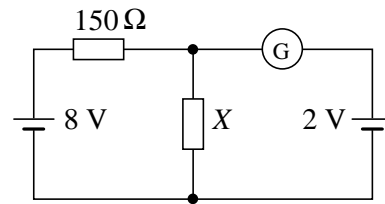
28.



A charged capacitor  $C$ , of  $10 \mu\text{F}$  capacitance, is connected in the circuit above. For a period of  $40 \text{ s}$ , the current is kept constant at  $20 \mu\text{A}$  by continuous adjustment of  $R$ . During this period, the p.d. across the capacitor has fallen by

- A.  $8.0 \times 10^{-4} \text{ V}$
- B.  $1.3 \times 10^{-2} \text{ V}$
- C.  $14 \text{ V}$
- D.  $20 \text{ V}$
- E.  $80 \text{ V}$

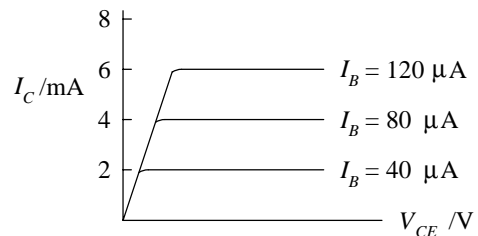
29.



In the circuit shown above, the galvanometer  $G$  reading is zero. So  $X$  has a resistance of

- A.  $15 \Omega$
- B.  $25 \Omega$
- C.  $50 \Omega$
- D.  $100 \Omega$
- E.  $150 \Omega$

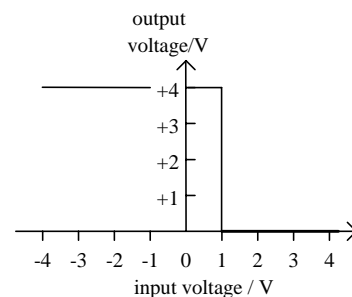
30.




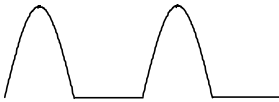

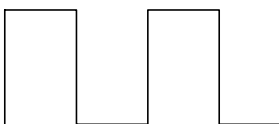
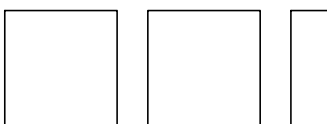
The graphs show the characteristics for a transistor operating in the common emitter mode.  $I_C$  is the collector current,  $I_B$  is the base current and  $V_{CE}$  is the potential difference between the collector and emitter. The current gain for this transistor is

- A. 20
- B. 50
- C. 80
- D. 100
- E. 150

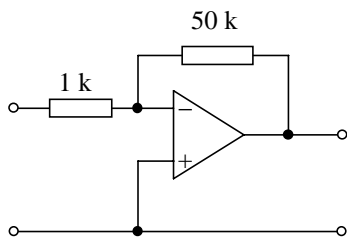
31. The graph shows the transfer characteristic of an electronic device.



The input is a sinusoidal voltage with a peak value of 1.5 V and a mean value of zero. Which one of the following waveforms best represents the variation of the output voltage with time?

- A. 
- B. 
- C. 
- D. 
- E. 

32.



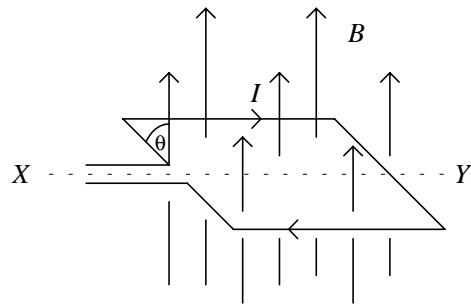
In the circuit above, what is the voltage amplification?

- A. 50 000 with inversion
- B. 1 000 with inversion
- C. 50 with inversion
- D. 50 without inversion
- E. 50 000 without inversion

33. A moving-coil galvanometer with a coil of area  $A$  and  $N$  turns has a full-scale deflection for a current  $i$ . If the coil were of area  $3A$  and  $2N$  turns, the current which would give full scale deflection would be

- A.  $i/6$
- B.  $2i/3$
- C.  $i$
- D.  $3i/2$
- E.  $6i$

34.

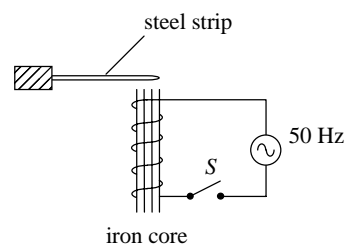


A square coil of  $N$  turns and area  $A$  carries a current  $I$ . The coil is free to rotate about the axis  $XY$  which is normal to a uniform magnetic field  $B$ . When the field makes an angle  $\theta$  with the plane of the coil, what are the magnitude and direction of the torque acting on the coil as detected by an observer by  $X$ ?

Magnitude                      Direction

- A.  $BANI \cos \theta$                       clockwise
- B.  $BANI \sin \theta$                       clockwise
- C.  $BANI \cos \theta$                       anticlockwise
- D.  $BANI \sin \theta$                       anticlockwise
- E. none of the above

35.



When switch  $S$  is closed, the steel strip will

- A. remain stationary
- B. remain attracted to the iron core
- C. vibrate at a frequency of 50 Hz

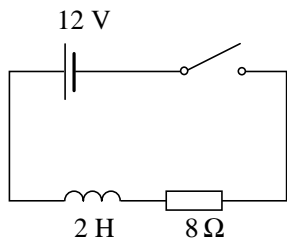
- D. vibrate at a frequency of 100 Hz
- E. vibrate at a frequency of 200 Hz

36. Two parallel straight conductors separated by a distance  $r$  carry currents in the same direction. Which of the following statements is/are correct?

- (1) The two wires attract each other.
- (2) The force acting on each wire is inversely proportional to  $r^2$ .
- (3) The wires produce a magnetic field with maximum flux density midway between them.

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

37.

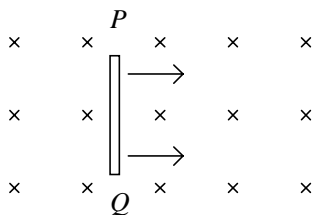


When the switch in the circuit is closed,

- (1) the current will rise initially at the rate of 6 A/s,
- (2) the final value of the current is 1.5 A,
- (3) the final energy stored in the inductor is 2.25 J.

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

38.

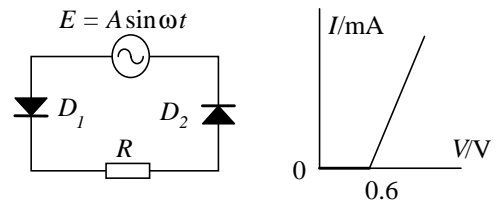


In the above figure, when the metal rod  $PQ$  moves with constant velocity across a uniform magnetic field, a p.d. is induced across the rod. Which of the following statements is/are correct?

- (1) The magnitude of the p.d. depends on the length of the rod.
- (2)  $Q$  is at a higher potential than  $P$ .
- (3) A force is acting on the rod to oppose its motion.

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

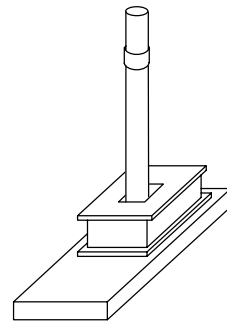
39.



In the circuit shown above,  $D_1$ ,  $D_2$  are two diodes used to rectify a sinusoidal a.c. supply. Each of the diodes has the  $I$ - $V$  characteristic as shown. For a current to flow through  $R$ , the minimum value of  $A$  is

- A. 0.6 V
- B. 1.2 V
- C.  $0.3\sqrt{2}$  V
- D.  $0.6\sqrt{2}$  V
- E.  $1.2\sqrt{2}$  V

40.

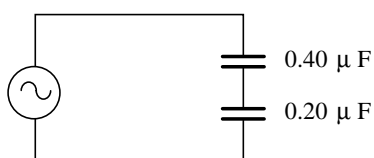


A metal ring is made to float above a coil carrying alternating current. Which of the following will affect the height of the ring?

- (1) the resistivity of the ring
- (2) the density of the ring
- (3) the frequency of the alternating current

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

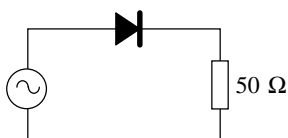
41.



In the above circuit, the a.c. source has a r.m.s. voltage of 5.0 V alternating at 50 Hz. What is the r.m.s. current?

- A. 0.033  $\mu\text{A}$
- B. 0.12  $\mu\text{A}$
- C. 0.21 mA
- D. 120 mA
- E. 210 mA

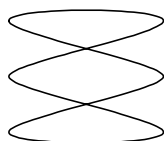
42.



In the above circuit, if the sinusoidal a.c. source has a peak-to-peak voltage of 20 V, the r.m.s. current through the 50  $\Omega$  resistor is

- A. 0.07 A
- B. 0.10 A
- C. 0.14 A
- D. 0.20 A
- E. 0.28 A

43.



A.C. voltages of frequencies  $f_1$  and  $f_2$  are applied to the x-plates and y-plates of a CRO respectively. The trace observed is shown above.  $f_1 : f_2$  is equal to

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

44. The main reason why a chain reaction can occur in a nuclear reactor using uranium is that

- A. a large quantity of energy is evolved in each fission.
- B. the products of nuclear fission are highly radioactive.
- C. plutonium is produced and it undergoes further fission.
- D. neutrons are produced when a nucleus undergoes fission.
- E. uranium is a highly radioactive element.

45. A radioactive source consists of a mixture of two radioisotopes  $P$  and  $Q$ .  $P$  has a half-life of 1 hour and  $Q$  has a half-life of 2 hours. Both  $P$  and  $Q$  have stable daughter nuclei. The initial activity recorded by a counter is 600/min. After 4 hours the counter registers an activity of 60 counts per min. What was the contribution of  $P$  to the initial count rate (in counts per min.)?

- A. 120
- B. 200
- C. 360
- D. 400
- E. 480

46. The work function of a metal is the least energy required to

- A. release one mole of electrons from the surface of the metal.
- B. bring one mole of electrons from the interior of the metal to the surface.
- C. releases one electron from the surface of the metal.
- D. bring one electron from the interior of the metal to the surface.

- E. bring one electron from the interior of the metal to the surface and release it.
47. Which of the following conclusions could NOT be deduced from Rutherford's scattering experiment?
- (1) Alpha particles are helium nuclei.
  - (2) There are discrete energy levels in an atom.
  - (3) The positive charge in an atom is confined to a very small region.
- A. (1), (2) and (3)
  - B. (1) and (2) only
  - C. (2) and (3) only
  - D. (1) only
  - E. (3) only
48.  $N_7^{14} + \text{alpha particle} \rightarrow \text{proton} + X$
- In the above nuclear reaction,  $X$  is
- A.  $O_8^{17}$
  - B.  $F_9^{17}$
  - C.  $N_8^{17}$
  - D.  $C_6^{11}$
  - E.  $F_9^{18}$
49. The emf of a thermocouple  $E$  is measured at a number of Celsius temperatures  $\theta$ .  $E$  and  $\theta$  are related by
- $$E = a\theta + b\theta^2, \text{ where } a \text{ and } b \text{ are constants}$$
- The above relationship can most easily be verified by plotting a graph of
- A.  $E$  against  $\theta$
  - B.  $E/\theta$  against  $\theta$
  - C.  $E/\theta^2$  against  $\theta$
  - D.  $E$  against  $\theta^2$
  - E.  $\log E$  against  $\log \theta$
50. To determine the area of cross-section of a metal wire, a student measures its diameter and obtains a value of 0.20 mm, subject to an error of  $\pm 0.02$  mm. Which of the following is the most appropriate way of expressing the result?
- A.  $0.03 \pm 0.01 \text{ mm}^2$
  - B.  $0.031 \pm 0.003 \text{ mm}^2$
  - C.  $0.031 \pm 0.006 \text{ mm}^2$
  - D.  $0.0314 \pm 0.0031 \text{ mm}^2$
  - E.  $0.0314 \pm 0.0063 \text{ mm}^2$

- END OF PAPER -

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