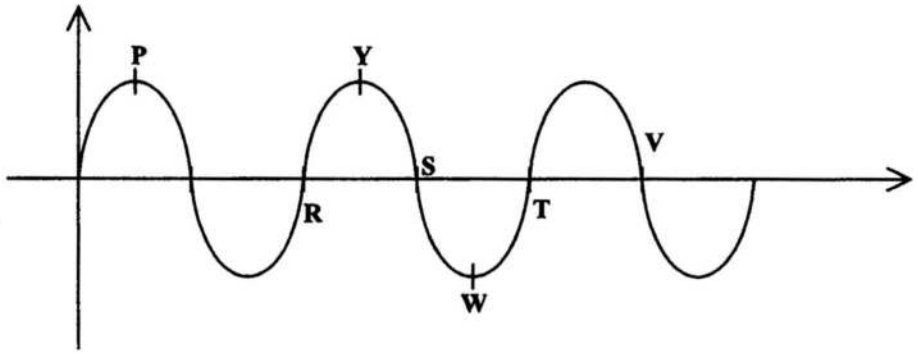
Item 1 refers to the following graph.



1. Which of the following pair of points are in phase?

(A) Y, W
(B) P, R
(C) S, V
(D) S, T

---

2. Given that force = mass × acceleration, the unit of force could be written as

(A) $kg^{-1}\ m\ s^{2}$
(B) $kg\ m^{-1}\ s^{2}$
(C) $kg\ m^{-1}\ s^{-2}$
(D) $kg\ m\ s^{-2}$

3. The SI unit of temperature is the

(A) Celsius
(B) Fahrenheit
(C) Kelvin
(D) Centigrade

4. In carrying out an experiment to locate a real image using a converging lens, the object can be placed

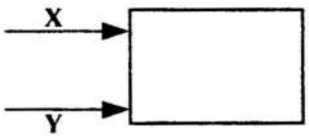
I. between the focal point and the lens
II. at the focal point
III. between the focal point and a point at twice the focal length

(A) I only
(B) I and III only
(C) II and III only
(D) III only

5. The moment of a force may be defined as the

(A) moment in time when a force is first applied to a body
(B) length of time for which a force is applied to a body
(C) product of the force and its perpendicular distance from the turning point to the force
(D) ratio of the force and its perpendicular distance from the turning point

Item 6 refers to the following diagram which shows two forces, X and Y, applied onto an object.



6. What should be the magnitude and direction of a third force which will cause the object to remain stationary?

(A) $X - Y$ to the left
(B) $X + Y$ to the left
(C) $X - Y$ to the right
(D) $X + Y$ to the right

7. When a force F is applied to a spring of original length L the new length becomes $L + x$. What would be the new length of the spring if a force of $\frac{F}{2}$ was applied instead?

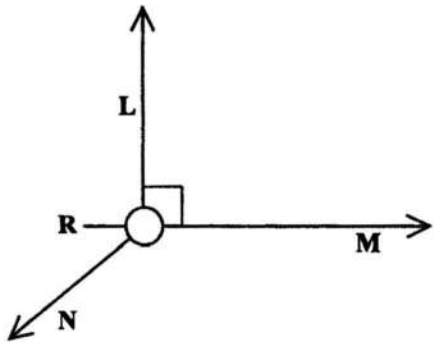
(A) $L + 2x$

(B) $2(L + x)$

(C) $L + x$

(D) $L + \frac{x}{2}$

Item 8 refers to the following diagram which shows three forces of magnitudes L, M and N, all in the **same plane** and applied on a ring.



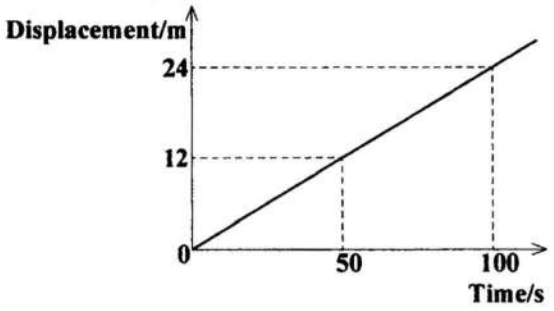
8. Which of the following equations must be TRUE in order for the ring to remain stationary?

(A) $L^2 = M^2 + N^2$
(B) $N^2 = L^2 + M^2$
(C) $N^2 = L^2 - M^2$
(D) $N = L + M$

9. Two forces of 8 N and 10 N CANNOT give a resultant of

(A) 1 N
(B) 2 N
(C) 9 N
(D) 18 N

Item 10 refers to the following graph which shows how the displacement of a runner from a starting line varies with time.



10. From the graph it can be deducted that the runner is

(A) not moving
(B) going at a steady speed
(C) going faster and faster
(D) going slower and slower

11. A block is allowed to fall freely towards the ground. As it falls, its gravitational potential energy

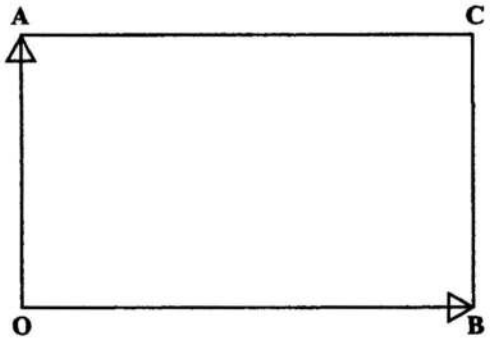
(A) increases
(B) remains constant
(C) is converted to internal energy
(D) is converted to kinetic energy

12. Two smooth spheres, A and B, collide head on. Which of the following statements is/are TRUE?

I. The momentum of A is the same after collision as it was before.
II. The momentum of B is the same after collision as it was before.
III. The total momentum of A and B is the same after collision as it was before.

(A) I only
(B) III only
(C) II and III only
(D) I, II and III

Item 13 refers to the following diagram which shows two vectors of magnitudes a and b represented respectively by $\overrightarrow{OA}$ and $\overrightarrow{OB}$.



13. The vectors act at point O and are directly perpendicular to each other. Which of the following pairs represents BOTH the magnitude and direction of their resultant?

	Magnitude	Direction
(A)	$a^2 + b^2$	$\overrightarrow{OC}$
(B)	$a + b$	$\overrightarrow{CO}$
(C)	$\sqrt{(a^2 + b^2)}$	$\overrightarrow{CO}$
(D)	$\sqrt{(a^2 + b^2)}$	$\overrightarrow{OC}$

14. The height of liquid in a vessel is h and its density ρ. If the atmospheric pressure is X and the acceleration due to gravity is g, what is the pressure on the base of the vessel? (All quantities are in SI units.)

(A) $X + h\rho$
(B) $(X + h)\rho g$
(C) $X + h\rho g$
(D) $(X + h\rho)g$

15. The specific latent heat of vaporization of water is 2.26×10^6 J kg^{-1}. When 0.01 kg of water is converted into steam it

(A) absorbs 2.26×10^4 J
(B) gives out 2.26×10^4 J
(C) absorbs 2.26×10^8 J
(D) gives out 2.26×10^8 J

16. A body weighs 60 N on earth. When taken to the moon the body weighs 10 N. Which of the following would be the MAIN reason(s) for this fact?

I. The earth rotates more slowly than the moon.
II. The earth has a larger mass than the moon.
III. On the moon there is no atmosphere.

(A) I only
(B) II only
(C) II and III only
(D) I, II and III

Item 17 refers to the following diagram of a clinical thermometer.



17. What temperature is indicated by the clinical thermometer in the diagram above?

(A) 38.3 °C
(B) 38.6 °C
(C) 38.7 °C
(D) 38.8 °C

18. Under what conditions may we apply the following gas formula to solve problems?

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

I. The mass of gas must be constant.
II. P_1 and P_2 must be measured in mm of mercury.
III. The units of the product P_1 and V_1 must be the same as the units of the product of P_2 and V_2.

(A) I only
(B) II only
(C) I and III only
(D) I, II and III

19. Who was responsible for arriving at the conclusion that measured amounts of electrical and mechanical energy can be converted to proportionate amounts of heat energy?

(A) Joule
(B) Rumford
(C) Coulomb
(D) Newton

20. Which of the following methods is the MOST suitable means of heating a brass bob in order to determine its specific heat capacity by the method of mixtures?

(A) Subjecting it to an open flame for ten minutes
(B) Placing it in contact with an electrical heater for ten minutes
(C) Placing it in a boiling water bath for ten minutes
(D) Subjecting it to an infrared beam for ten minutes

21. The energy required to change the state of a substance was determined to be E_H. If the mass of the substance was DOUBLED, the value of E_H will

(A) be halved
(B) be doubled
(C) be quadrupled
(D) remain constant

22. Which of the following statements is FALSE?

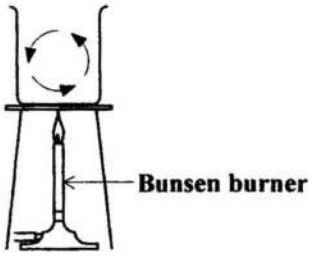
(A) Evaporation occurs at room temperature only.
(B) Evaporation requires heat energy and causes cooling.
(C) Evaporation occurs only at the surface.
(D) In evaporation the faster molecules escape the liquid.

23. Most refrigerators are painted white because a white surface is

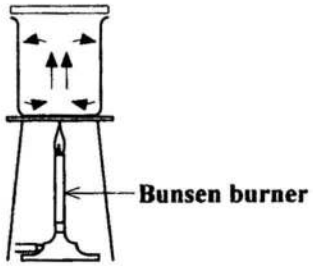
(A) easily cleaned
(B) a good reflector of thermal radiation
(C) a good absorber of radiation
(D) a poor reflector of radiation

24. Which of the following diagrams BEST illustrates convection current in a liquid?

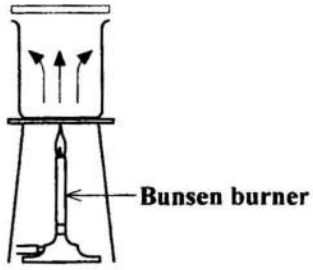
(A)



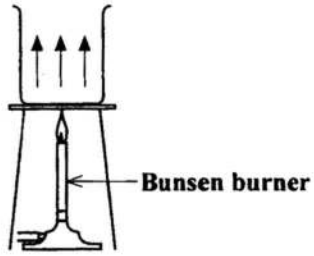
(B)



(C)



(D)



25. The heat from a nearby fire reaches us MAINLY by

(A) conduction
(B) convection
(C) absorption
(D) radiation

26. Which of the following is the POOREST conductor of thermal energy?

(A) Air
(B) Copper
(C) Mercury
(D) Aluminium

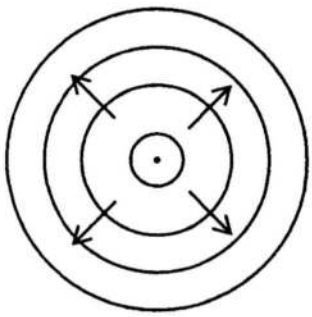
27. Which of the following descriptions refer to BOTH a good absorber and a good emitter of thermal (heat) energy?

(A) A polished, concave metal plate
(B) A polished, convex metal plate
(C) A flat, polished metal plate
(D) A flat metal plate, painted black

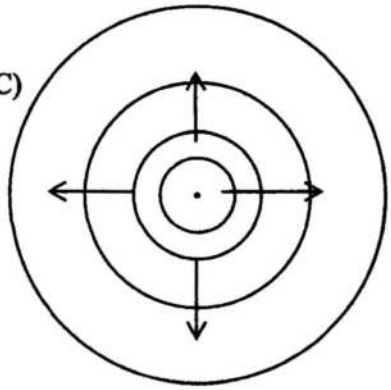
---

28. Which of the following diagrams BEST represents the wave generated in a ripple tank by a small spherical dipper vibrating at a constant frequency?

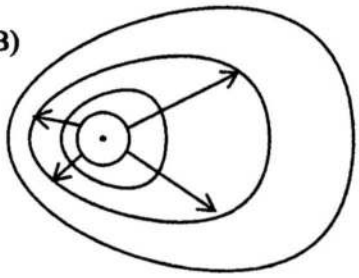
(A)



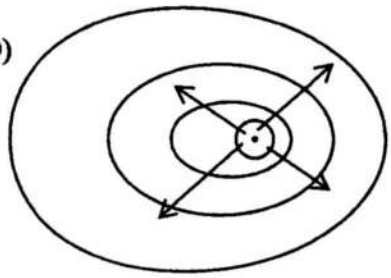
(C)



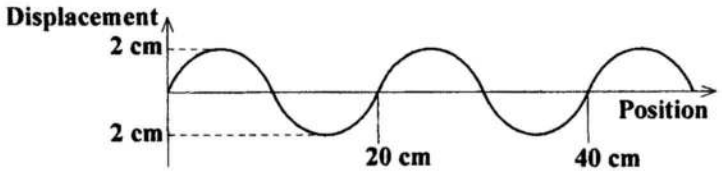
(B)



(D)



Item 29 refers to the following diagram which shows the instantaneous profile of a wave travelling across a water surface.



29. From the information given, the frequency is

(A) $\frac{1}{20}$ Hz

(B) 10 Hz

(C) 20 Hz

(D) unknown

30. The range of frequencies detectable by the normal human ear is

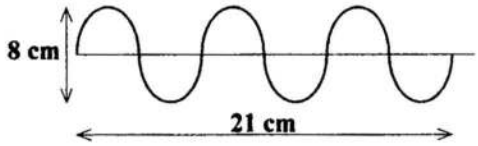
(A) 10 Hz to 100 Hz

(B) 20 Hz to 20 KHz

(C) 10 Hz to 10 KHz

(D) 20 Hz to 2000 KHz

Item 31 refers to the following diagram which illustrates the side view of a water wave.



31. The amplitude of the wave is

(A) 4 cm

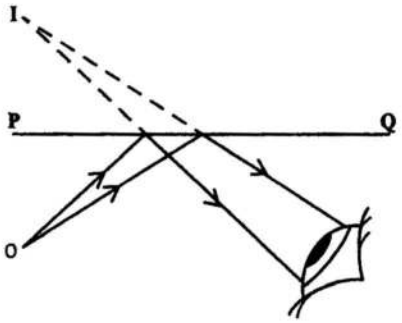
(B) 7 cm

(C) 8 cm

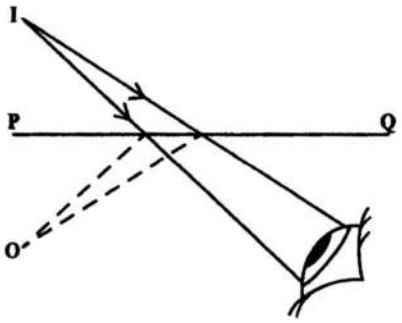
(D) 21 cm

32. An object O is viewed in a plane mirror PQ. Which of the following diagrams correctly shows the formation of the image?

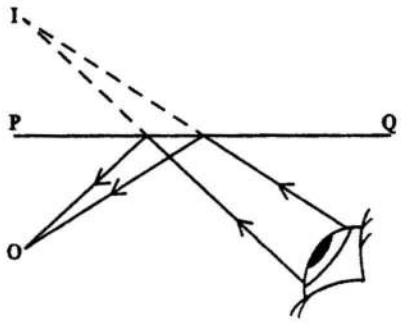
(A)



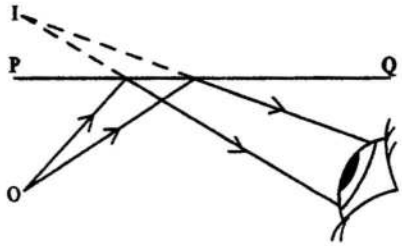
(C)



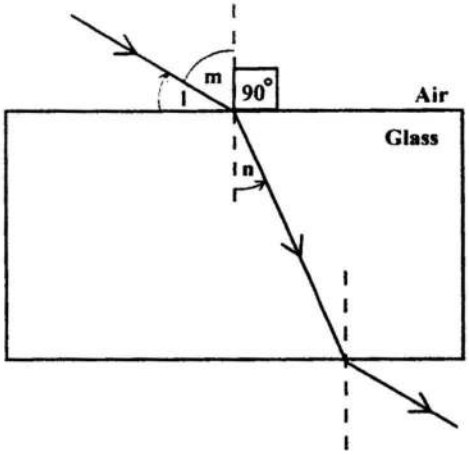
(B)



(D)



Item 33 refers to the following diagram.



33. From the diagram above, the refractive index of glass can be determined from the ratio

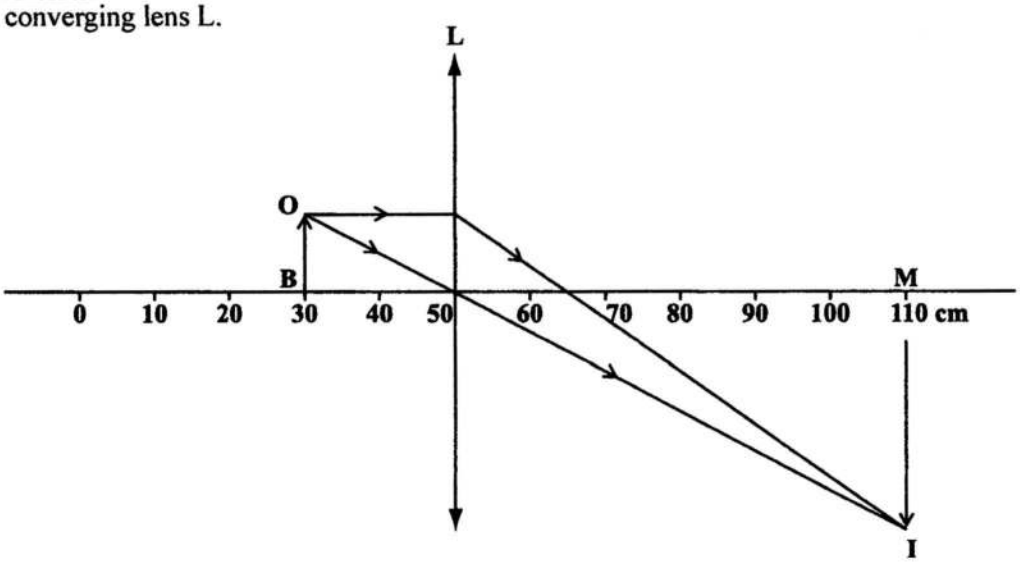
(A) $\frac{\text{Sin m}}{\text{Sin l}}$

(B) $\frac{\text{Sin m}}{\text{Sin n}}$

(C) $\frac{\text{Sin l}}{\text{Sin 90}}$

(D) $\frac{\text{Sin 90}}{\text{Sin n}}$

Item 34 refers to the following diagram which represents an object OB standing on the axis of the converging lens L.



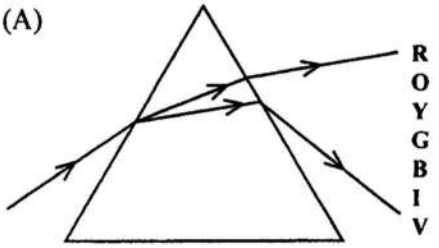
IM represents the image formed. The lens is placed at the 50 cm mark of a scale marked every 10 cm.

34. The focal length of the lens is

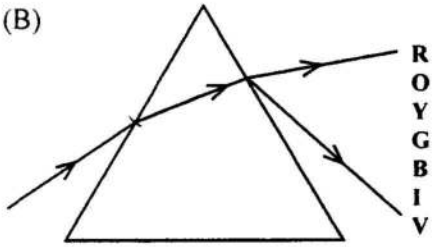
(A) 15 cm
(B) 20 cm
(C) 60 cm
(D) 65 cm

35. A ray of white light enters a transparent glass prism. In which of the following diagrams is the dispersion of light correctly illustrated?

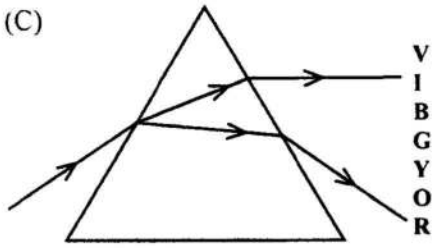
(A)



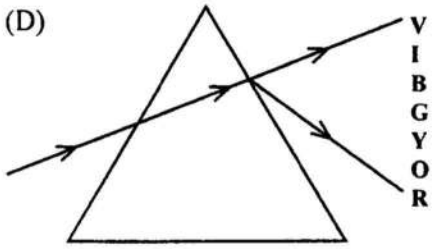
(B)



(C)

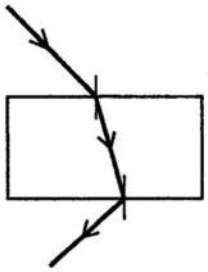


(D)

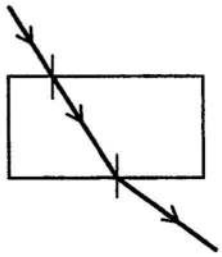


36. Which diagram BEST shows the path taken by a ray of light through a rectangular block?

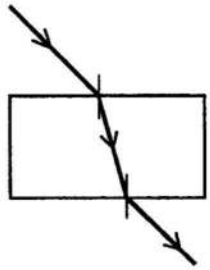
(A)



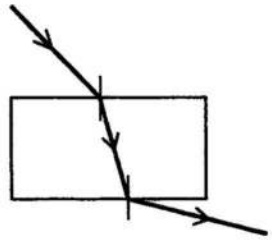
(B)



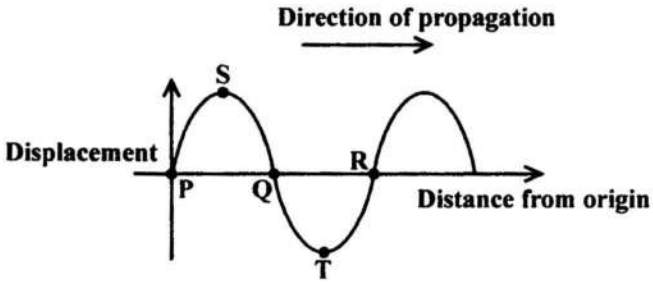
(C)



(D)



Item 37 refers to the following diagram.



37. Which of the following statements about the wave shown in the diagram is/are true?

I. Points P, Q and R are in phase.
II. Points S and T are out of phase.
III. The wavelength of the wave is the distance PR.

(A) I only
(B) II only
(C) I and II only
(D) II and III only

38. In which of the following would a change be detected if sounds of differeing frequencies are played in succession? (Assume amplitude constant.)

(A) Loudness
(B) Speed
(C) Pitch
(D) Timbre

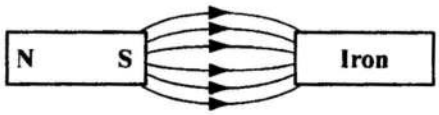
39. Magnetic induction occurs when

(A) an N pole attracts a S pole
(B) iron nails near a magnet become magnetized
(C) a magnet is suspended and points in the NS direction
(D) an electroscope is charged

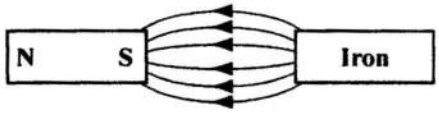
40. Which of the following electromagnetic waves has the SHORTEST wavelength?

(A) Gamma rays
(B) Infrared waves
(C) Radio waves
(D) Ultraviolet radiation

41. Which of the following diagrams shows the magnetic field between a bar magnet and a piece of iron?

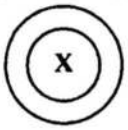
(A) 

(B) 

(C) 

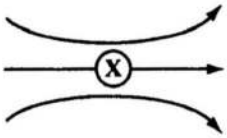
(D) 

Item 42 refers to the following diagram which represents a straight wire carrying a current into the plane of a piece of paper.

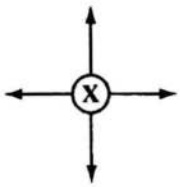


42. Which of the following diagrams BEST represents the magnetic field around the wire?

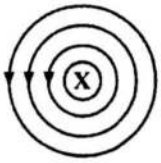
(A)



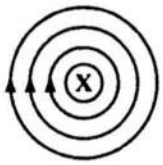
(B)



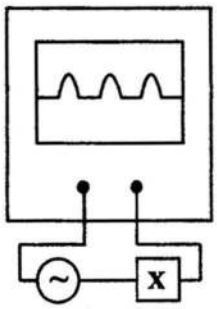
(C)



(D)



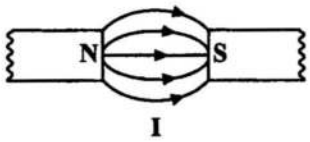
Item 43 refers to the following diagram which shows the trace on the screen of an oscilloscope wired to an a.c. supply and a device **X**.



43. **X** is probably a

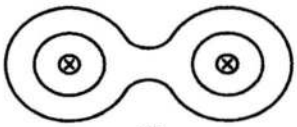
(A) diode
(B) resistor
(C) solenoid
(D) transformer

Item 44 refers to the following diagrams labelled I, II and III.



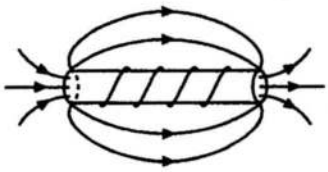
Two permanent magnets

I



Parallel wires carrying equal currents in the same direction into the paper

II



Current flowing in a solenoid

III

44. Which of the diagrams above correctly show(s) the magnetic fields created?

(A) I only
(B) I and III only
(C) II and III only
(D) I, II and III

45. Which of the following materials is MOST suitable for the core of an electromagnet?

(A) Steel
(B) Copper
(C) Carbon
(D) Soft iron

46. Which of the following circuit symbols represents a fuse?

(A) 

(B) 

(C) 

(D) 

47. An ammeter has a very low resistance so that it can be placed in

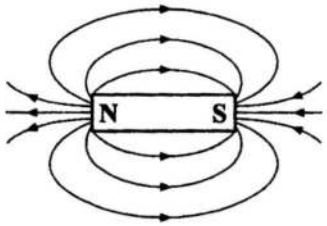
(A) parallel with a component and not affect the circuit
(B) series with a component and not affect the circuit
(C) parallel with a component and the ammeter does not heat up
(D) series with a component and the ammeter does not heat up

48. An ideal transformer has a primary to secondary turns ratio of 1:3. An alternating potential difference of 200 V is applied to the primary coil and a resistance of 200 Ω attached to the secondary coil. What is the current in the secondary circuit?

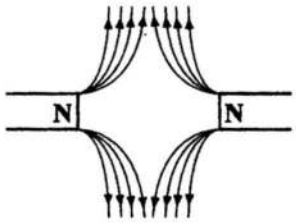
(A) 0.33 A
(B) 1.0 A
(C) 1.5 A
(D) 3.0 A

---

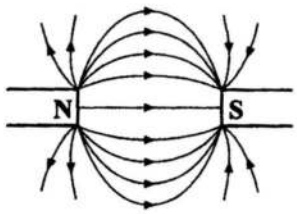
49. The following diagrams labelled I, II and III, show the magnetic field lines plotted by a student.



I



II



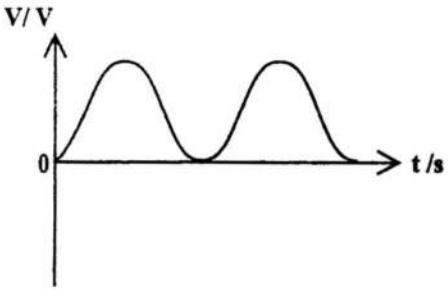
III

Which of the following are correct?

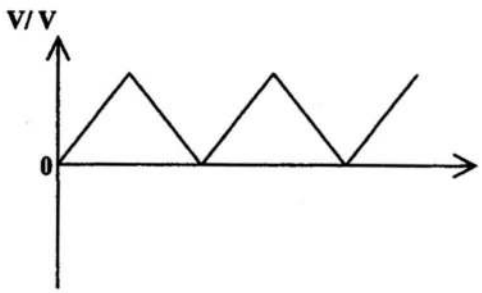
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

50. Which of the following voltage (V) – time (t) graphs BEST represents an a.c. voltage?

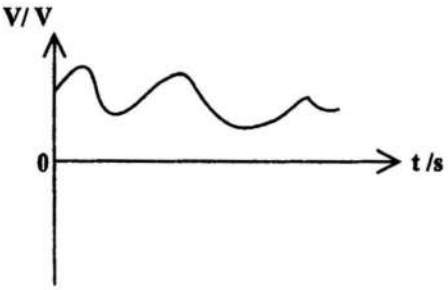
(A)



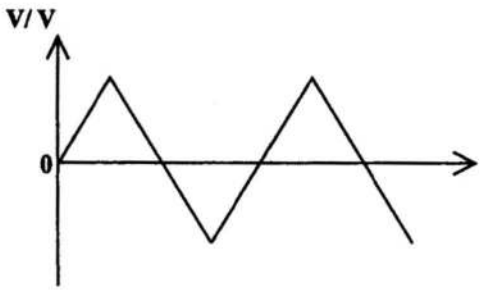
(C)



(B)

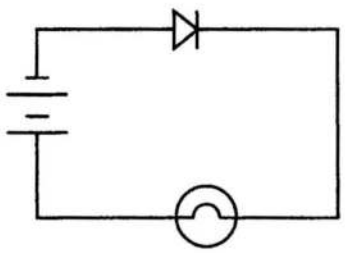


(D)

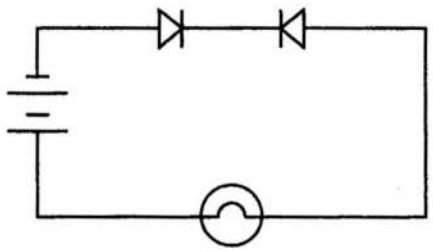


51. In which of the following circuits will the lamp light up?

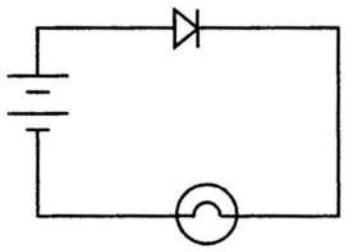
(A)



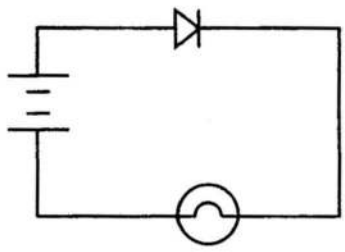
(C)



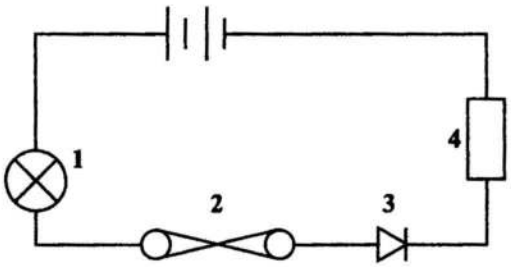
(B)



(D)



Item 52 refers to the following diagram.



52. Which of the following options shows the correct match of the component name and its number?

	Diode	Lamp	Resistor	Fuse
(A)	3	1	4	2
(B)	4	3	1	2
(C)	1	3	4	2
(D)	2	4	3	1

53. Given the following truth table with inputs A and B and output C, which logic gate does it describe?

A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

(A) NAND
(B) NOR
(C) AND
(D) OR

54. In the scattering experiment conducted by Geiger and Marsden, some of the alpha particles were deflected. The explanation for this phenomenon is that

(A) electrons have a small mass
(B) electrons have a small charge
(C) the metal foil was only a few atoms thick
(D) the nuclear charge and mass are concentrated in a small volume

55. Which of the following CANNOT be deflected by a magnetic field?

(A) Alpha particles
(B) Beta particles
(C) Gamma rays
(D) Electrons

56. Which of the following are definitions of the term 'half-life' of a radioactive nuclide?

I. The time taken for the activity of any given sample to fall to half its original value.
II. The time taken for half the nuclei present in any given sample to decay.
III. It is half the average number of disintegrations per second.

(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

57. The nuclide $^{234}_{90}Th$ contains

(A) 90 protons and 234 neutrons
(B) 235 protons and 90 neutrons
(C) 90 protons and 144 neutrons
(D) 144 protons and 90 neutrons

58. Which of the following statements describe the nature of the three types of emissions from radioactive substances?

I. Alpha radiation is a stream of helium nuclei.
II. Beta radiation is a stream of electrons.
III. Gamma radiation is an electromagnetic radiation of very high frequency.

(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

59. Which of the following scientists discovered the relationship $E = mc^2$?

(A) Marie Curie
(B) Isaac Newton
(C) Albert Einstein
(D) J J Thompson

60. Which of the following equations for nuclear reactions is correct?

(A) $^{226}_{88}\text{Ra} \rightarrow {}^{222}_{86}\text{Rn} + \beta - \text{particle}$

(B) $^{14}_{6}C \rightarrow {}^{15}_{7}N + \beta - \text{particle}$

(C) $^{226}_{88}\text{Ra} \rightarrow {}^{222}_{86}\text{Rn} + \alpha - \text{particle}$

(D) $^{14}_{6}C \rightarrow {}^{15}_{7}N + \alpha - \text{particle}$

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.