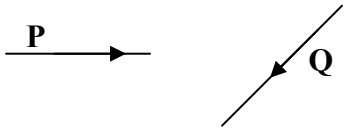
1. Which of the following statements is **false**?

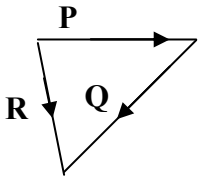
   A. A dimensionally consistent equation is a physically correct equation.
   B. The principle of homogeneity of unit of an equation cannot determine the value of a unitless or dimensionless constant in the equation.
   C. For an equation to be physically correct, it must have dimensional consistency.
   D. The principle of homogeneity of an equation cannot discriminate between two quantities having the same units (e.g. length of pendulum string, radius of pendulum bob).

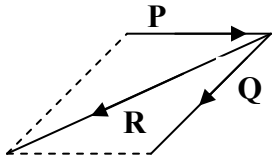
2. The wall thickness of a cylindrical glass tube is determined by measuring its external and internal diameters with vernier calipers. If the readings obtained are (25.45 ± 0.01) cm and (22.35 ± 0.01) cm respectively, the wall thickness of the glass tubing is

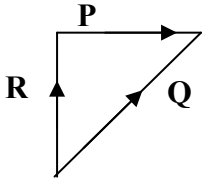
   A. 3.10 ± 0.02 cm
   B. 1.55 ± 0.02 cm
   C. 3.10 ± 0.01 cm
   D. 1.55 ± 0.01 cm

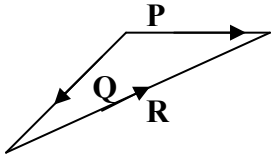
3. 

   The above figure shows two vector **P** and **Q**. Which of the following vector diagram shows the correct direction for the resultant vector **R**.

   A. 

   B. 

   C. 

   D. 

4. Which one of the followings has different dimensions from the others?

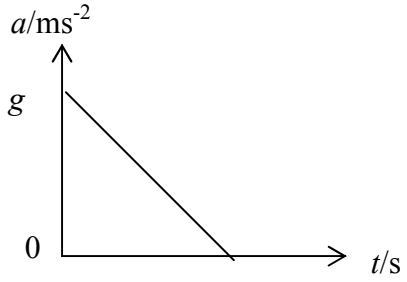
   A. Stress x Strain
   B. Stress/Strain
   C. Torque
   D. Potential energy per unit volume

5. A small car of mass 800 kg, is being driven in foggy condition. In this situation the maximum deceleration of the car is 7.5 ms^{-2}. While driving at the constant speed of 21 ms^{-1}, the driver sees a stationary car 30 m ahead and takes 0.40 s to react. Determine the speed at which the car will hit the stationary car.

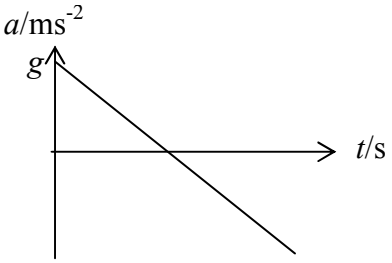
   A. 3.0 ms^{-1} B. 5.2 ms^{-1} C. 10.8 ms^{-1} D. 12.3 ms^{-1}

6. An object is projected vertically upwards. Assuming air resistance is negligible, the acceleration of the object from the time it is projected until it returns to the ground can be correctly illustrated by the graph

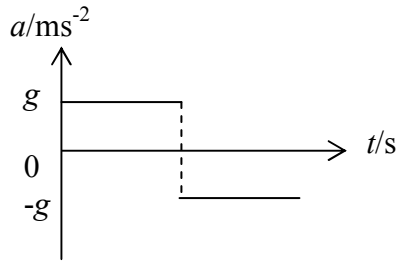
A.



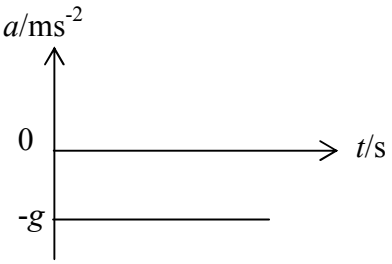
B.



C.



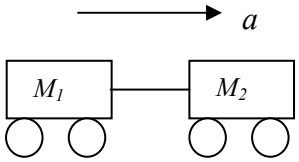
D.



7. A car of mass 1.2 x 10^3 kg moves up an incline at a steady velocity of 15 ms^{-1} against a friction force of 0.6 kN. The incline is such that it rises 1.0 m for every 10 m along the incline. Determine the output power of the car engine.

   A. 26.6 kW
   B. 30.0 kW
   C. 33.3 kW
   D. 35.0 kW

8.



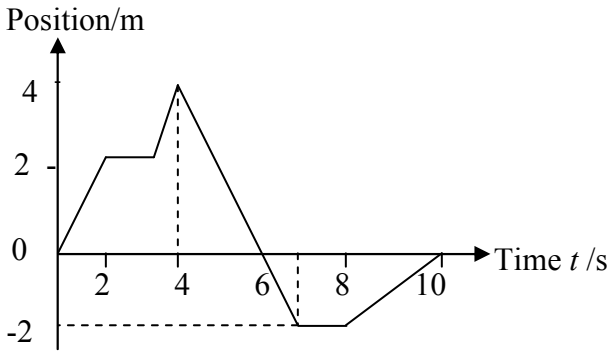
An engine of mass M_2 is pulling a truck of mass M_1, the acceleration of the system being a. The engine exerts a tractive force F and the truck and the engine are both subjected to effective resistances R_1 and R_2 respectively. The tension in the coupling between the engine and truck is T. Which of the following equation is **incorrect**?

A. $F - T - R_2 = M_2a$
B. $T - R_1 = M_1a$
C. $F - R_1 - R_2 = (M_1 + M_2)a$
D. $F = (M_1 + M_2)a$

9. A crane has a maximum safe working load of 1200 kg and is used to lift a concrete block of mass 1000 kg. What is the maximum safe upward acceleration of the block whilst being lifted?

A. 0.19 ms^{-2}
B. 0.85 ms^{-2}
C. 1.52 ms^{-2}
D. 1.96 ms^{-2}

10.



In demonstrating a dance step, a person moves in one dimension as shown in above graph. What is the average velocity between time, $t = 4$ s and $t = 8$ s.

A. 0.50 ms^{-1} B. 0.67 ms^{-1} C. 1.50 ms^{-1} D. 2.00 ms^{-1}

11. The inference made from Browian motion is that

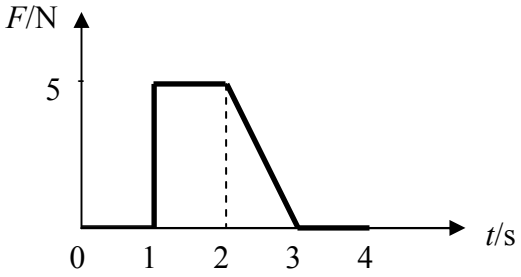
A. gas molecules exist and can be seen as bright dots moving about randomly.

B. smoke particles can be used as models of air molecules.

C. gas molecules exist and move about randomly at high speeds.

D. smoke particles and air molecules move about randomly.

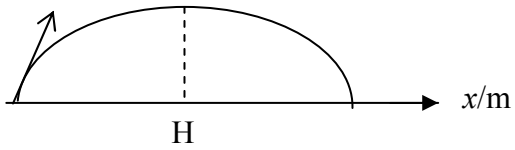
12.



The graph above shows the variation of force, F acting on a body with time, t. The change in momentum of the body during this 4 s period is

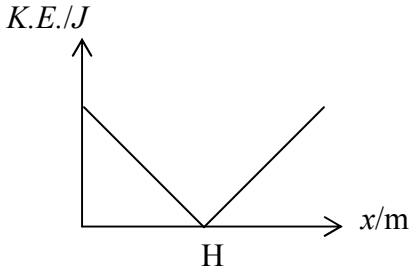
A. 5.0 Ns B. 7.5 Ns C. 15.0 Ns D. 20.0 Ns

13.

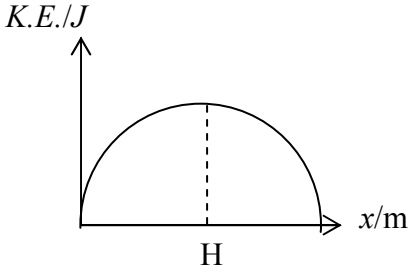


Which of the graphs below represents the kinetic energy, *K.E.* of a body in a parabolic motion as shown above?

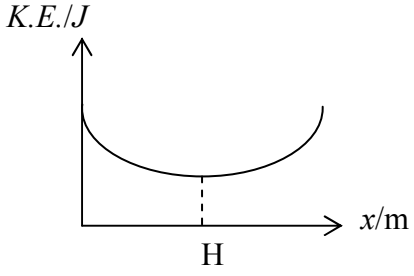
A.



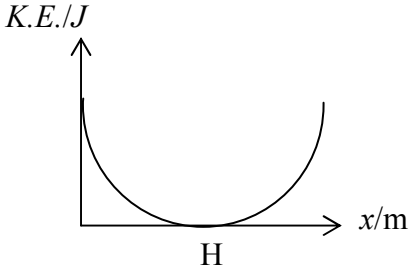
B.



C.



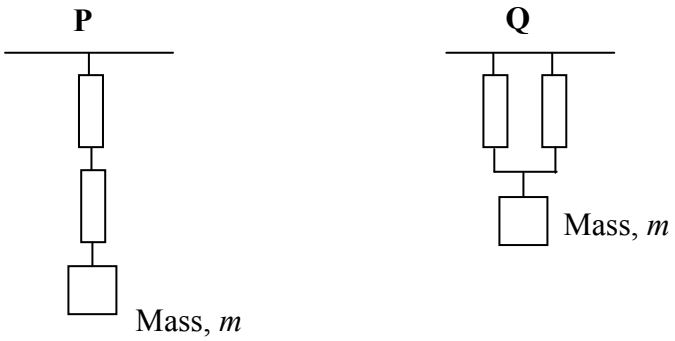
D.



14. For inelastic collision, which are the quantities that are conserved?

A. Total momentum and total energy of the system.
B. Total momentum and total kinetic energy of the system.
C. Total kinetic energy and total energy of the system.
D. Total momentum, total kinetic energy and total energy of the system.

15.

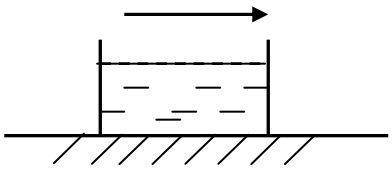


A series of identical springs of constant k are connected up as shown in P and Q. The 2 springs in P can be replaced by a single spring of constant k_P while the 2 springs in Q can be replaced by a single spring constant k_Q. What is the ratio $\frac{k_P}{k_Q}$?

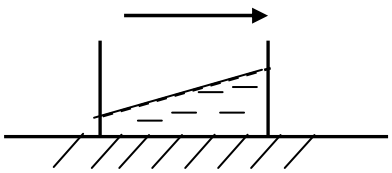
A. $\frac{1}{4}$ B. $\frac{2}{3}$ C. $\frac{4}{3}$ D. $\frac{3}{4}$

16. The diagram above shows a container partially filled with water. The container is then accelerated to the right with a constant acceleration. Which of the diagrams below best represents the motion?

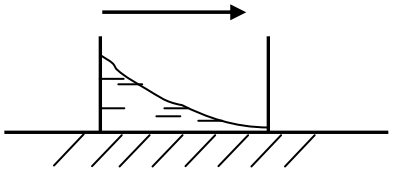
A



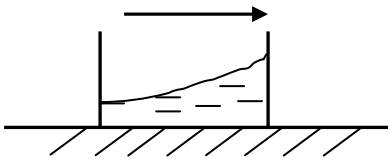
B



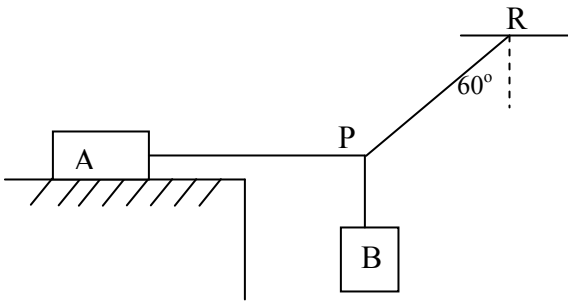
C



D



17.



The figure above shows body A and body B in equilibrium. Given that the tension in the string PR is T, the weight of body B is W and the friction between body A and the rough surface is R, which list gives the three forces in increasing order of magnitude?

A. T,W,R B. T,R,W C. W,R,T D. R,T,W

18. Which of the following statements about glass is **wrong**?

A. Glass does not melt at a fixed temperature because all its bonds do not break at the same temperature.
B. Glass is very viscous when melted, so that upon freezing the molecules cannot arrange themselves in an orderly, regular pattern.
C. Glass consists of long molecular chains interlinked together such that as the temperature is raised, the chains uncoil and attempt to straighten.
D. The intermolecular forces are such that glass is stiff but not strong.

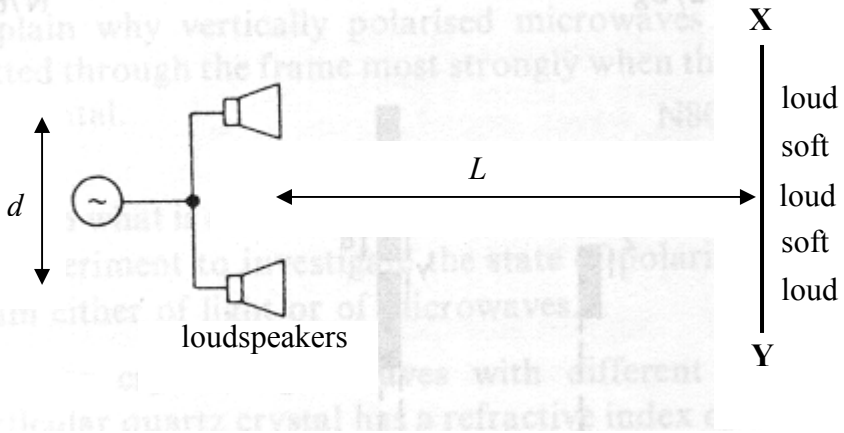
19. A wire of Young's modulus E is subjected to a stretching stress, σ. What is the elastic potential energy stored per unit volume of the wire?

A. $\frac{\sigma^2}{2E}$ B. $\frac{\sigma E}{2}$ C. $\frac{\sigma^2 E}{2}$ D. $\frac{\sigma}{2E}$

20. During an experiment to find Young's modulus for a wire, a graph of stress against strain was plotted. If, W is the force applied,
L is the original length of the wire,
A is the area of cross-section and
e is the extension of the wire, which of the following graphs should be plotted?

A. W/e against L/A
B. e/W against L/A
C. W/A against e/L
D. e/L against W/A

21. The figure below shows two identical loudspeakers driven in phase from a common audio – frequency source.



When a student moves from **X** to **Y**, the intensity of the note he hears is alternately loud and soft. Adjacent loud and soft regions may be made further apart by

A. decreasing the amplitude.

B. decreasing distance *d*.

C. decreasing distance *L*.

D. using a higher frequency.

22. A point source of sound emits energy equally in all directions at a constant rate and a person 6 m from the source listens. After a while, the intensity of the source is halved. If the person wishes the sound to seem as loud as before, how far should he be now from the source?

A. $\sqrt{2}$ m B. $2\sqrt{2}$ m C. $3\sqrt{2}$ m D. $4\sqrt{2}$ m

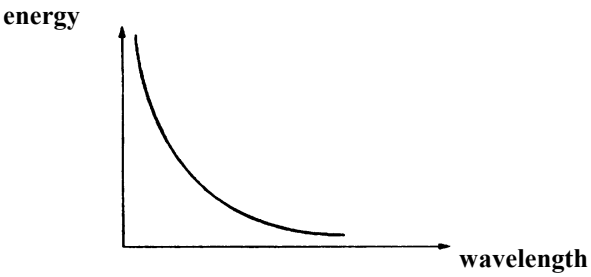
23. Progressive waves of frequency 400 Hz are superimposed to produce a system of stationary waves in which adjacent nodes are 1.5 m apart. What is the speed of the progressive waves in ms^{-1}?

A. 200 B. 400 C. 800 D. 1200

24. A resonance tube open at both ends and responding to a tuning fork

A. always has a central node.
B. always has a central antinode.
C. always has an odd number of nodes.
D. always has an odd number of nodes + antinodes.

25. The diagram shows the relationship between the energy of electromagnetic radiation and the wavelength of the waves.



Which of the following has the lowest energy?

A. microwaves
B. infrared
C. ultra-violet
D. X-rays

26. Which of the following summarizes the change in wave characteristics on going from violet light to red light in the electromagnetic spectrum?

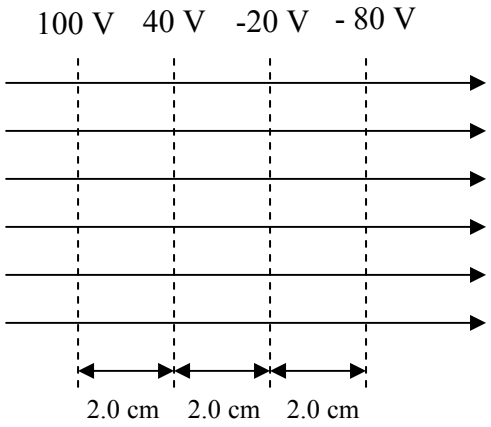
	frequency	Degree of diffraction by a single slit
A.	decreases	increases
B.	decreases	remains constant
C.	increases	remains constant
D.	increases	decreases

27. Coherent light is incident on two fine parallel slits, $\mathbf{S_1}$ and $\mathbf{S_2}$, as shown in the diagram.

If a bright fringe occurs at **P**, which of the following gives possible phase differences for the light waves arriving at **P** from $\mathbf{S_1}$ and $\mathbf{S_2}$?

A. $\pi, 3\pi, 5\pi \ldots$
B. $2\pi, 4\pi, 6\pi \ldots$
C. $\pi, 2\pi, 3\pi \ldots$
D. $\pi/2, 3\pi/2, 5\pi/2 \ldots$

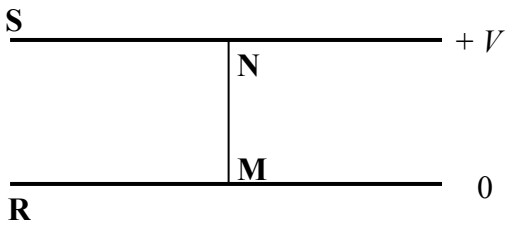
28. The diagram shows a uniform electric field in which the lines of equal potential are spaced 2.0 cm apart.



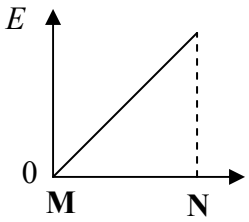
What is the value of the electric force which is exerted on a charge + 6.0 μC when placed in the field?

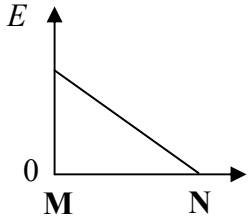
A. 1.8×10^{-2} N B. 2.8×10^{-2} N C. 3.8×10^{-2} N D. 4.8×10^{-2} N

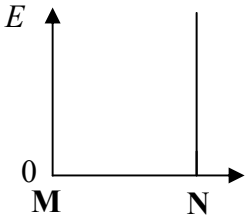
29. Two horizontal conducting plates **R** and **S** are a fixed distance apart. Plate **S** is at potential $+V$ with respect to plate **R**. **MN** is a line perpendicular to the plates.

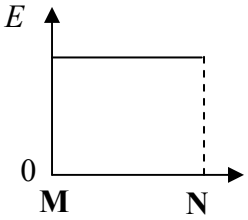


Which graph shows how the magnitude E of the electric field strength varies along the line **MN**?

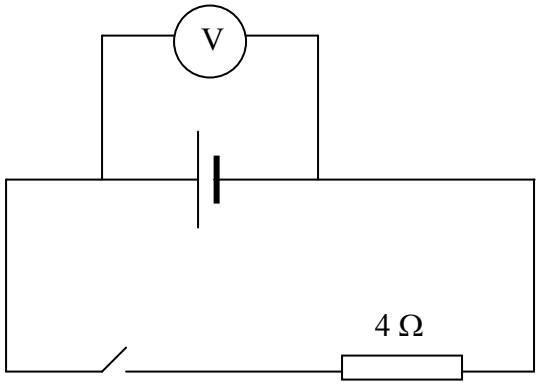
A. 

B. 

B. 

D. 

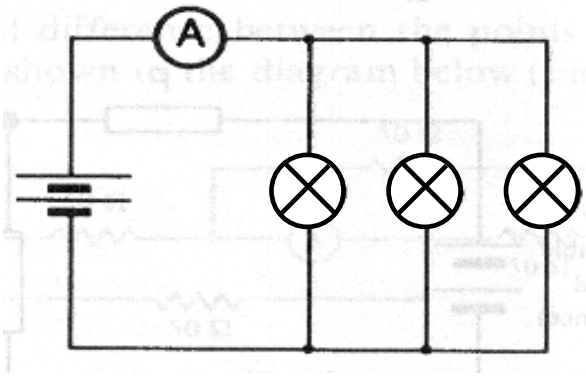
30. A cell is connected in series with a 4 Ω resistor and a switch as shown in the figure below. A voltmeter connected across the cell reads 12 V when the switch is open but 8 V when it is closed.



What is the internal resistance of the battery?

A. 1 Ω B. 2 Ω C. 3 Ω D. 4 Ω

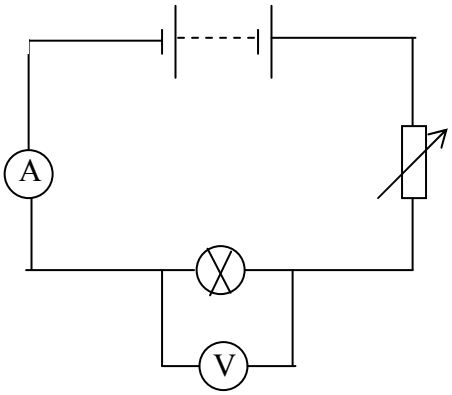
31. Three similar light bulbs are connected to a constant – voltage d.c. supply as shown in figure below. Each bulb operates at normal brightness and the ammeter (of negligible resistance) registers a steady current.



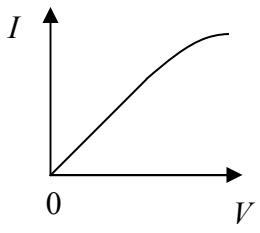
The filament of one of the bulbs breaks. What happens to the ammeter reading and to the brightness of the remaining bulbs?

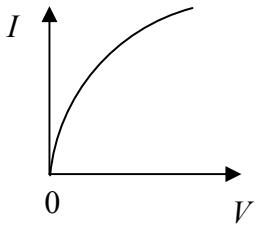
	ammeter reading	bulb brightness
A.	increases	increases
B.	increases	unchanged
C.	decreases	unchanged
D.	unchanged	unchanged

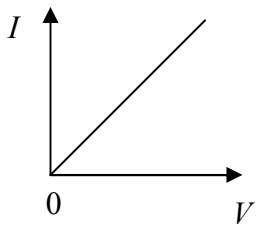
32. The diagram shows a metal filament lamp connected in series with an ammeter, battery and a variable resistor. A high resistance voltmeter is connected across the lamp.

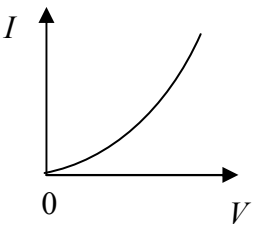


Which graph represents the variation of I, the current through the lamp, with the potential difference V across it?

A.


B.


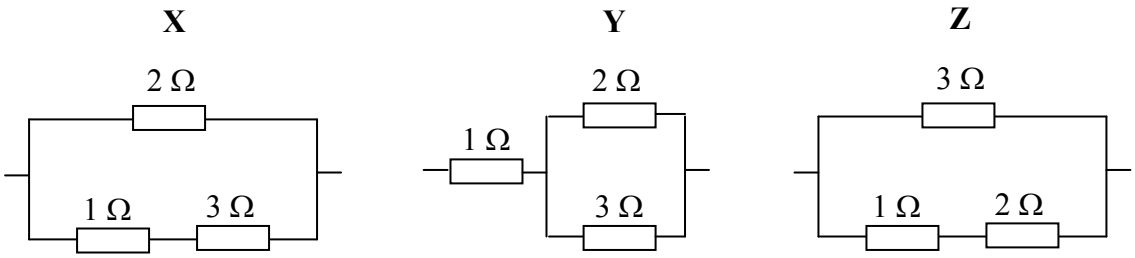
C.


D.


33. A cell of e.m.f. E delivers a charge Q to an external circuit. Which statement is correct?

A. The energy dissipation in the external circuit is EQ
B. The energy dissipation within the cell is EQ
C. The external resistance is EQ
D. The total energy dissipation in the cell and the external circuit is EQ

34. Three resistors of resistance 1 Ω, 2 Ω and 3 Ω respectively are used to make the combinations **X**, **Y** and **Z** shown in the diagrams.

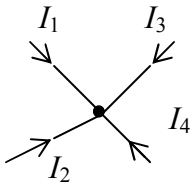


Which of the following gives the combinations in order of *increasing* resistance?

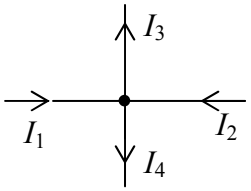
A. **XZY** B. **XYZ** C. **YXZ** D. **ZXY**

35. The diagrams show four different ways in which currents I_1, I_2, I_3 and I_4 can combine at a junction. For which of these junctions is the following equation correct? $I_1 + I_2 = I_3 + I_4$

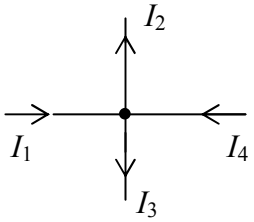
A.



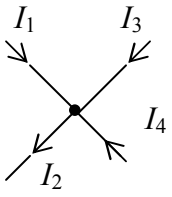
B.



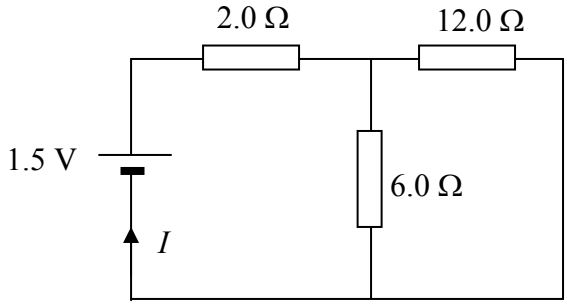
C.



D.



36. A 1.5 V cell and three resistors of resistance 2.0 Ω, 6.0 Ω and 12.0 Ω respectively are connected as shown below.



What is the value of I ?

A. 0.10 A B. 0.15 A C. 0.25 A D. 0.30 A

37. A certain radioactive nuclide of nucleon number m_x, disintegrates, with the emission of an electron and γ - radiation only, to give a second nuclide of a nucleon number m_y. Which one of the following equations correctly relates m_x and m_y?

A. $m_y = m_x$
B. $m_y = m_x - 1$
C. $m_y = m_x + 1$
D. $m_y = m_x + 2$

38. An event on a distant star causes the emission of a burst of radiation containing β-particles, γ-rays and light. Which one of the following statements about the order in which these radiations arrive at the Earth is *correct*?

A. The light would arrive first.
B. The γ-rays would arrive first.
C. The light and the γ-rays would arrive together, ahead of the β-particles.
D. The light and the β-particles would arrive together, ahead of the γ-rays.

39. A naturally occurring isotope of radium, $^{226}_{88}Ra$, has a half-life of 1622 years. Its radioactive decay may be represented by the equation

$$^{226}_{88}Ra \longrightarrow X + \alpha + \gamma.$$

Where X is a daughter nuclide, α is an alpha-particle and γ is a gamma ray, the proton number of X is

A. 86 B. 88 C. 222 D. 224

40. $^{238}_{92}U$ decays through a series of transformations to a final stable nuclide. The particles emitted in the successive transformations are

α β β α α

Which nuclide represents the final stable nuclide?

A . $^{226}_{88}Ra$ B. $^{223}_{90}Th$ C . $^{234}_{91}Pa$ D. $^{234}_{92}U$

[End of questions]