Answer to this Paper must be written on the paper provided separately.
You will not be allowed to write during first 15 minutes.
This time is to be spent in reading the question paper.
The time given at the head of this Paper is the time allowed for writing the answers.
Section A is compulsory. Attempt any four questions from Section B.
The intended marks for questions or parts of questions are given in brackets [].

SECTION A (40 MARKS)
(Attempt all questions from this Section)

QUESTION 1 [15]

Choose the correct answers to the questions from the given options:

(i) A body is acted upon by two UNEQUAL and opposite forces along different lines of action of force. The body will have

(a) only rotatory motion
(b) only translatory motion
(c) both (a) and (b)
(d) neither (a) and (b)

(ii) A heavy duty wrench or a spanner has:

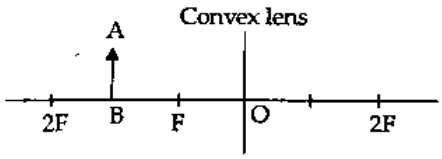
(a) short handle
(b) long handle
(c) length of handle does not matter
(d) none of these

(iii) One horse power is equal to:

(a) 764 Js^{-1} (b) 746 Js^{-1} (c) 700 Js^{-1} (d) 674 Js^{-1}

(iv) From the diagram given alongside, identify the characteristic which is incorrect for the image formed by the convex lens.

(a) Image is enlarged (b) Image is virtual (c) Image is inverted
(d) Image is formed beyond 2F on right hand side.



(v) A uniform plank 8 m long is balanced on a pivot at its centre. A boy weighing 60 kgf sits at distance of 2.5 m from the pivot. The distance from pivot where another boy of mass 55 kgf sits in order to balance the plank is:

(a) 2.63 m (b) 2.83 m (c) 2.73 m (d) 2.93 m

(vi) A single movable pulley has:

(a) Velocity ratio 2 and actual mechanical advantage 2
(b) Velocity ratio 2 and actual mechanical advantage less than 2
(c) Velocity ratio 2 and actual mechanical advantage more than 2
(d) None of these

(vii) The S.I unit of thermal capacity is:

(a) J kg^{-1} (b) kJ kg^{-1} (c) JK^{-1} (d) Cal $^{o}C^{-1}$

(viii) The snow does not melt rapidly on mountains in summer because:

(a) It is fairly cool on mountains (b) Specific heat capacity of ice is very high

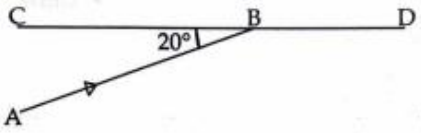
(c) Specific latent heat of ice is highest for any substance

(d) None of these

(ix) The ratio of speed of light in vacuum to the speed of light in a given medium is 15 : 7. The refractive index of medium is:

(a) 2.18 (b) 2.14 (c) 2.11 (d) 2.17

(x) AB is a sound wave striking a high wall at an angle of 20°. The angle between the incident ray and the reflected ray is :



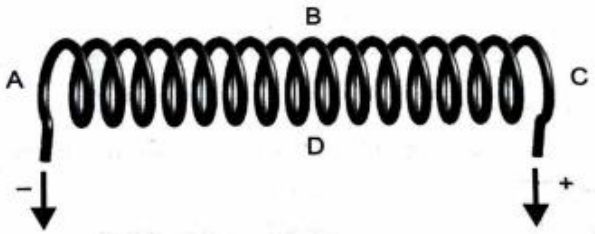
(a) 70° (b) 90° (c) 120° (d) 140°

(xi) A crack in window pane appears silvery when viewed from some particular angle. The phenomenon is due to:

(a) reflection of light (b) refraction of light

(c) total internal reflection of light (d) dispersion of light

(xii) A solenoid is wound with many turns and carrying current as shown below. The south pole of the solenoid is



(a) located at A (b) located at B

(c) located at C (d) located at D

(xiii) Infrared rays with very large wavelength are easily reflected by:

(a) air (b) glass

(c) carbon dioxide molecules (d) both (b) and (c)

(xiv) Which is not condition for the formation of an echo?

(a) Minimum distance between source of sound and reflecting body be 17 m

(b) Temperature of air should be above 20°C

(c) The wavelength of sound should be less than the height of reflecting body.

(d) The intensity of sound should be sufficient, so that it could be heard reflection.

(xv) The sound is produced by two tuning forks A and B have same amplitude and same waveform, but frequency of A is three times more than B. In such case:

(a) Quality of sound A differs from B. (b) Note produced by A is shiller than B.

(c) Note produced by B is shiller than A. (d) Note produced by A has more speed than B.

QUESTION 2

(i) Complete the following sentences : [3]

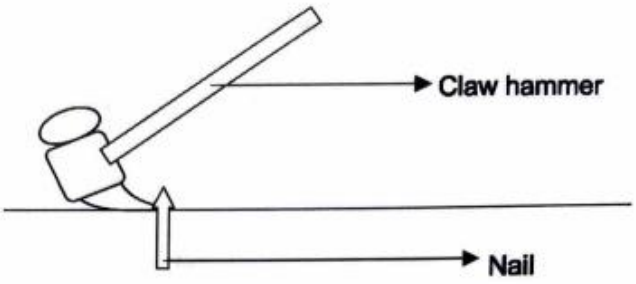
(a) When ice melts, its volume ..... .

(b) The angle of deviation is maximum for ..... when the dispersion of polychromatic light takes place

(c) Emf of a cell is ..... the terminal voltage when cell is not in use, while ..... the terminal voltage when cell is in use.

(ii) State two ways to increase the speed of rotation of a D.C. motor. [2]

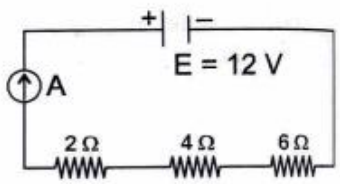
(iii) The diagram below shows a claw hammer used to remove a nail: [2]



(a) To which class of lever does it belong?

(b) Give one more example of the **same class** of lever mentioned by you in (i) for which the **mechanical advantage is greater than one.**

(iv) Study the circuit diagram alongside carefully and calculate: [2]



(a) Current registered by ammeter A.

(b) P.D across 4 W resistor

(v) (a) What does watt-hour represent in current electricity? [2]

(b) What is its value in S.I units?

(vi) An electric kettle draws an electric current of 4 A for 10 minutes. If the resistance of its element is 40 Ω, calculate the energy drawn by kettle in kilo-joules. [2]

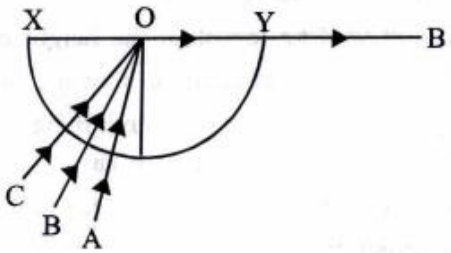
(vii) How does the magnetic field set up by a solenoid change when: [2]

(a) Strength of current in it is increased?

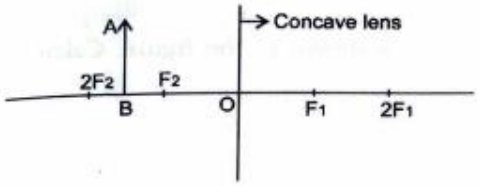
(b) Soft iron core is placed within it?

QUESTION 3

(i) The diagram below shows the section of a semi-circular glass block having centre at O, A, B, and C are monochromatic rays of light of the same colour. On the diagram, mark the critical angle by i_c. Draw the path of rays A and C after they strike the edge XY. Name the phenomenon which the rays A and C (into and out of the block) exhibit. [2]



(ii)

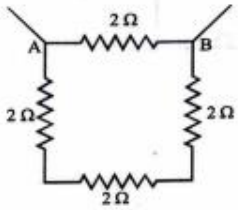


The diagram above shows a concave lens and an object AB placed between $2F_2$ and F_2. Copy the diagram and complete it to show the formation of image. [2]

(iii) Draw a neat diagram to show how an isosceles right-angled glass prism can deflect a ray of light through 180º. [2]

(iv) Why more than one image is formed in a thick glass mirror? Show by drawing a neat diagram. [No explanation is required] [2]

(v) What is equivalent resistance between A and B ? [2]



SECTION B
(Attempt any four questions)

QUESTION 4

(i) The diagram in Fig. shows the electrical system of a car to operate the two head lights and two rear lights by a switch. [5]

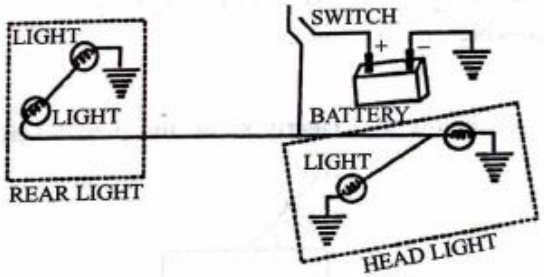


figure shows a connection to the body of the car.

(i) The diagram shows only one lead from the battery to each bulb, but a complete circuit must have two leads. How does the current get back to the battery?

(ii) The two rear lights as connected in diagram glow faintly. Why do they glow faintly ? How should they be connected to glow brightly? Show by a separate diagram.

(iii) If the lights are on, they become dim when the car is started. Give a reason.

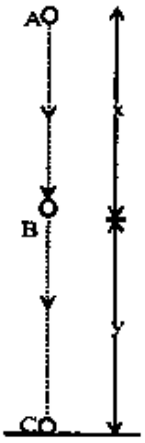
(ii) (a) A brass ball is hanging from a stiff nylon thread. Draw a neat labelled diagram showing the forces acting on brass ball and the nylon thread. [5]

(b) The distance between two freely suspended brass spheres is tripled. How does the magnitude of gravitational forces between them is affected?

(c) Why is a jack screw provided with long handle?

QUESTION 5

(i) An object of mass 'm' is allowed to fall freely from point A as shown in the figure. Calculate the total mechanical energy of the object at : [5]



(a) Point A

(b) Point B

(c) Point C

(d) State the law which is verified by your calculations in parts (i), (ii) and (iii).

(ii) A block and tackle system of pulleys has velocity ratio 5. [5]

(a) How many pulleys are in its movable block?

(b) What is the ideal mechanical advantage of this pulley system?

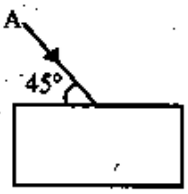
(c) If the movable block is connected to a weight of 20 kgf and the efficiency of pulley system is 80%, calculate the mechanical advantage of pulley system.

(d) What is the effort required to lift the weight of 20 kgf?

(e) What is weight of movable block?

QUESTION 6

(i) (a) Draw the diagram given below and clearly show the path taken by the emergent ray. [3]



(b) (i) A ray of light passes from water to air. How does the speed of light change?

(ii) Which colour of light travels fastest in any medium except air?

(c) Name the factors affecting the critical angle for the pair of media.

(ii) A piece of ice at 0°C is heated at a constant rate and its temperature is recorded at regular intervals of time, till steam is formed at 100°C. Draw a temperature-time graph to represent change in phase. Label different parts of graph. [3]

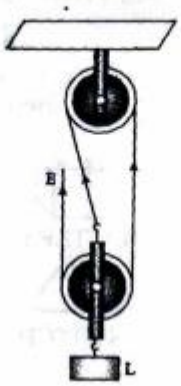
(iii) Diagram alongside show a pulley system when a load of 30 kgf is attached to a movable block. [4]

(a) What is the velocity ratio of pulley system ?

(b) What is the mechanical advantage of pulley system assuming it is ideal ?

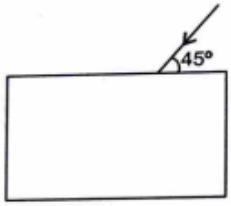
(c) What is the magnitude of effort applied ?

(d) If the pulley system is not ideal and is 60% efficient, what is the effort required ?



QUESTION 7

(i) Copy the diagram alongside and clearly show the path taken by emergent ray. **[2]**

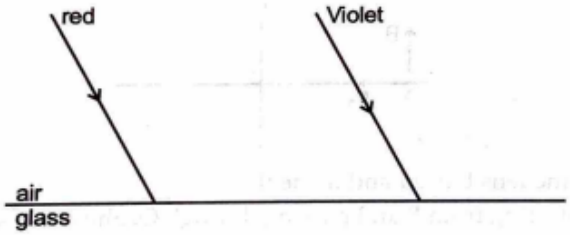


(ii) (a) A ray of light passes from alcohol to air. How does the speed of light change in air? **[4]**

(b) Which colour of visible light travels slowest in any medium except air?

(c) Name the factors affecting critical angle for the pair of media.

(iii) Two parallel rays of Red and Violet travelling through air, meet the air-glass boundary as shown in the figure :

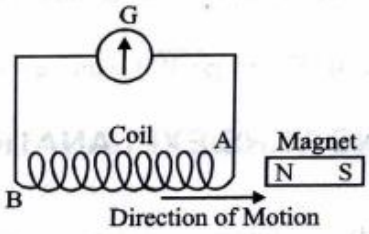


(a) Will their paths inside the glass be parallel ? Give a reason for your answer.

(b) Compare the speeds of the two rays inside the glass. **[4]**

QUESTION 8

(i) The following diagram shows a coil of several turns of copper wire connected to a sensitive centre-zero galvanometer G near a magnet NS. The coil is free to move. **[2]**



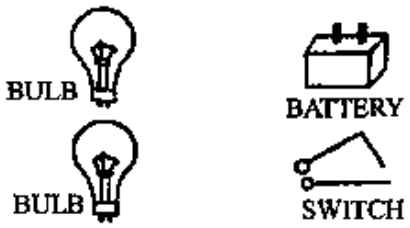
(*a*) Describe the observation if the coil is rapidly moved in the direction of arrow.

(*b*) How would the observation be altered if (*a*) the coil has twice as many turns,

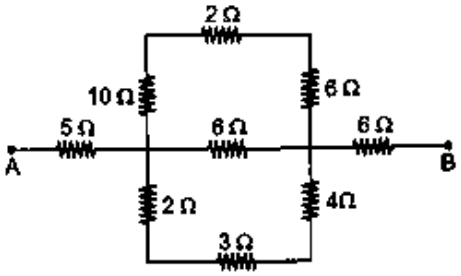
(*b*) the coil is made to move three times as fast ?

(ii) A sound made on the surface of lake takes 2 seconds to reach a boatman. How long it will take to reach diver inside lake water at the same distance as boatman. [Velocity of sound in air and water is 330 ms^{-1} and 1450 ms^{-1} respectively] [2]

(iii) The diagram in Fig. shows a battery, a switch and two bulbs. (*a*) Complete the diagram to show the electric connections of the bulbs to the battery. (*b*) How have you joined the bulbs in part (*a*)? Give reason. [3]

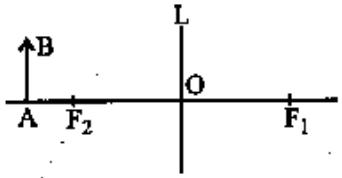


(iv) Calculate the equivalent resistance between points A and B. [3]



QUESTION 9

(i) The diagram shows an object AB placed on the principal axis of a lens L. f_1 and f_2 are foci. The image formed by the lens is erect, virtual and diminished. [5]



(a) Draw the outline of the lens L used and name it.

(b) Draw a ray of light starting from B and passing through O. Show the same ray after refraction by the lens.

(c) Draw another ray from B which is incident parallel to the principal axis and show how does it emerge after refraction from the lens.

(d) Locate the final image formed.

(ii) An atomic nucleus A is composed of 86 protons 136 neutrons. [5]

(a) The nucleus of A emits an alpha particle and is transformed into nucleus B. What is the composition of nucleus B?

(b) The nucleus B emits a beta particle and is transformed into nucleus C. What is the composition of nucleus C.

(c) Does the composition of nucleus C change, if it emits gamma radiation?