ICSE SEMESTER-1 EXAMINATION
PHYSICS
Solved Paper - 2021-22
Class-10th
Science Paper - 1

You will not be allowed to write during the first 10 minutes

This time is to be spent in reading the question paper.

ALL QUESTIONS ARE COMPULSORY.

The marks intended for questions are given in brackets [ ].

Select the correct option for each of the following questions.

*Max. marks : 40*   *Time allowed : One Hour*

1. The deviation produced by an equilateral prism does not depend on: **[1]**
   - (a) the angle of incidence.
   - (b) the size of the prism.
   - (c) the material of the prism.
   - (d) the colour of light used.

2. The refractive index of a diamond is 2.4. It means that: **[1]**
   - (a) the speed of light in vacuum is equal to 2.4 times the speed of light in diamond.
   - (b) the speed of light in the diamond is 2.4 times the speed of light in a vacuum.
   - (c) the speed of light in a vacuum is 2.4 times the speed of light in the diamond.
   - (d) the wavelength of light in diamond is 2.4 times the wavelength of light in vacuum.

3. An object of height 10 cm is placed in front of a concave lens of focal length 20 cm at a distance 25 cm from the lens. Is it possible to capture this image on a screen? Select a correct option from the following: **[1]**
   - (a) Yes, as the image formed will be real.
   - (b) Yes, as the image formed will be erect.
   - (c) No, as the image formed will be virtual.
   - (d) No, as the image formed will be inverted.

4. A ray of light IM is incident on a glass slab ABCD as shown in the figure below. The emergent ray for this incident ray is: **[1]**

   - (a) NQ
   - (b) NR
   - (c) NP
   - (d) NS
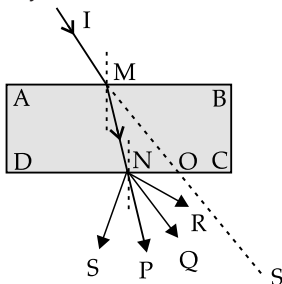
5. The colour of white light which is deviated least by a prism is: **[1]**
   - (a) green
   - (b) yellow
   - (c) red
   - (d) violet

6. The wavelength range of visible light is: **[1]**
   - (a) 40 nm to 80 nm
   - (b) 4000 nm to 8000 nm
   - (c) 4 nm to 8 nm
   - (d) 400 nm to 800 nm

7. Observe the diagram which shows the path of an incident ray through an optical plane LL' of a lens. The focal length of the lens is 20 cm.
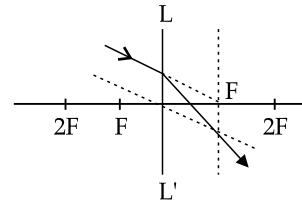
   - (i) If an object is placed at a distance of 30 cm in front of this lens, then: **[1]**
     - (a) the image will be virtual
     - (b) the image will be diminished and inverted.
     - (c) the image will be diminished.
     - (d) the image will be real and magnified.
   - (ii) This type of lens can be used: **[1]**
     - (a) to correct hypermetropia.
     - (b) to correct myopia.
     - (c) to diverge light.
     - (d) in the front door peepholes.
   - (iii) An object is placed in front of this lens at a distance of 60 cm. Then the image distance from the lens with proper sign convention is: **[1]**
     - (a) +60 cm
     - (b) +30 cm
     - (c) −30 cm
     - (d) +15 cm

(iv) An object is placed in front of this lens at a distance of 60 cm. Then the magnification of the image is: **[1]**

(a) 0.25   (b) 1.25

(c) −0.5   (d) 1

8. The relation between CGS and S. I. unit of moment of force is: **[1]**

    (a) $1 \, \text{Nm} = 10^5$ dyne cm

    (b) $1 \, \text{Nm} = 10^5$ dyne

    (c) $1 \, \text{Nm} = 10^7$ dyne cm

    (d) $1 \, \text{dyne cm} = 10^7$ N m

9. A coolie raises a load upwards against the force of gravity then the work done by the load is: **[1]**

(a) zero.   (b) positive work.

(c) negative work.   (d) none of these.
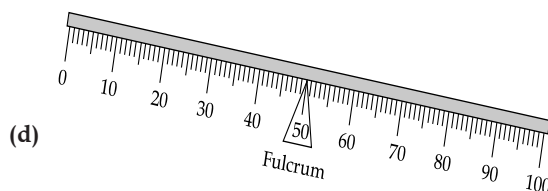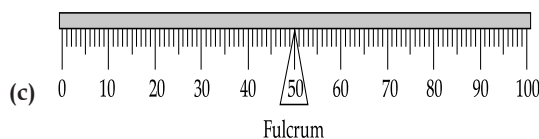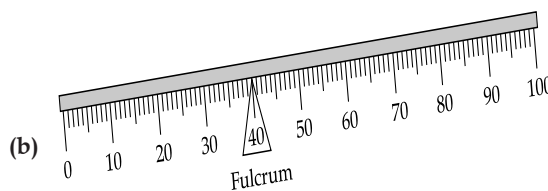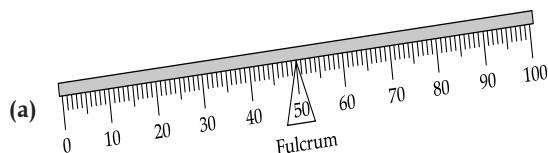
10. The energy change during photosynthesis in plants is:

(a) heat to chemical.   (b) light to chemical.

(c) chemical to light.   (d) chemical to heat.

11. The diagram below shows the balanced position of a metre scale. **[1]**

Fulcrum
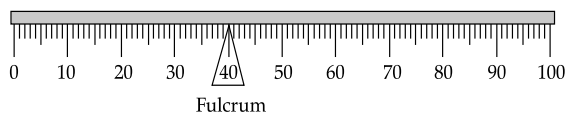
Which one of the following diagrams shows the correct position of the scale when it is supported at the centre?

(a)

(b)

(c)

(d)

12. A stone tied at the end of a string is whirled by hand in a horizontal circle with uniform speed.

(i) Name the force required for this circular motion: **[1]**

(a) Centrifugal force.

(b) Centripetal force.

(c) Force of gravity.

(d) Frictional force.

(ii) What is the direction of the above-mentioned force? **[1]**

(a) Towards the centre of the circular path.

(b) Away from the centre of the circular path'.

(c) Normal to the radius at a point where the body is present on the circular path.

(d) Direction of this force keeps on changing alternately towards and away from the centre.

13. A body of mass 200 g falls freely from a height of 15 m. [$g = 10 \, \text{ms}^{-2}$]

(i) When the body reaches 10 m above the ground, its potential energy will be·: **[1]**

(a) 20000 J   (b) 10 J

(c) 10000 J   (d) 20 J

(ii) The gain in kinetic energy of the body when it reaches 10 m above the ground is: **[1]**

(a) 20 J   (b) 10 J

(c) 30 J   (d) 25 J

(iii) The total mechanical energy it will possess, when it is just about to strike the ground is: **[1]**

(a) 30000 J   (b) 20000 J

(c) 30 J   (d) 20 J

(iv) The velocity in ms^{-1} with which the body will hit the ground is: **[1]**

(a) 30   (b) 10

(c) $10\sqrt{3}$ (d) $10\sqrt{2}$

14. A woman draws water from a well using a fixed pulley. The mass of the bucket and the water together is 10 kg. The force applied by the woman is 200 N.) The mechanical advantage is ($g = 10$ m/s^2): **[1]**

(a) 2   (b) 20

(c) 0.05   (d) 0.5

15. A single fixed pulley is used because: **[1]**

(a) it changes the direction of applied effort conveniently.

(b) it multiplies speed.

(c) it multiplies effort.

(d) its efficiency is 100%.

16. In the diagram shown below, the velocity ratio of the arrangement is: **[1]**

Rigid Support
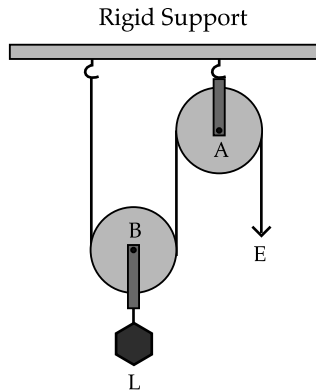
(a) 1   (b) 2

(c) 3   (d) 0

17. Which one of the following is the correct mathematical relation? **[1]**

(a) Power= Force / Velocity

(b) Power= Force × Acceleration

(c) Power= Force / Acceleration

(d) Power= Force × Velocity

18. Select a correct option with respect to echo depth sounding: **[1]**

(a) infrasonic waves are used.

(b) the frequency of the waves used is between 20 Hz and 20,000 Hz.

(c) ultrasonic waves are used.

(d) supersonic waves are used.

19. Which one of the following diagnostic methods use reflection of sound? **[1]**

(a) CT scan   (b) Electrocardiogram

(c) Echo cardiogram   (d) MRI

20. A boy standing in front of a wall produces two whistles per second. He notices that the sound of his whistling coincides with the echo. The echo is heard only once when whistling is stopped. Calculate the distance between the boy and the wall. (The speed of sound in air = 320 m/s)

(i) The time in which the boy hears the echo is: **[1]**

  (a) 1 s   (b) 0.5 s

  (c) 1.5 s   (d) 2 s

(ii) The distance at which the boy is standing from the wall: **[1]**

  (a) 160 m   (b) 240 m

  (c) 320 m   (d) 80 m

(iii) If the speed of sound is increased by 16 ms^{-1} and the boy moves 4 m away from the wall then in how much time will he hear the echo of the first whistle? **[1]**

  (a) 0.525 s   (b) 0.5 s

  (c) 0.48 s   (d) 0.3 s

(iv) In which of the following timings of reflection of the whistle, the echo cannot be heard? **[1]**

(a) 0.05 s   (b) 0.12 s

(c) 0.2 s   (d) 0.11 s

21. The ratio of velocities of light of wavelength 400 nm and 800 nm in a vacuum is: **[1]**

(a) 1 : 1   (b) 1 : 2

(c) 2 : 1   (d) 1 : 3

22. 1 joule = _____ erg **[1]**

(a) 10^9 (b) 10^7

(c) 10^5 (d) 10^6

23. A light body A and a heavy body B have the same momentum.

(i) Choose a correct statement from the given options. **[1]**

(a) kinetic energy of body A and body B will be the same.

(b) kinetic energy of body A is greater than kinetic energy of body B.

(c) kinetic energy of body B is greater than kinetic energy of body A.

(d) unless we know the velocity, we cannot find which body has greater kinetic energy.

(ii) If the ratio of kinetic energies of A and B is 5:2 then which one of the following gives the mass ratio of the bodies respectively? **[1]**

(a) 5 : 2   (b) 25 : 4

(c) 2 : 5   (d) 4 : 24

24. The diagram below shows a ray of light travelling from air into a glass material as shown below. Answer the questions that follow:
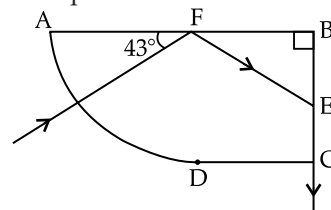
(i) The angle of incidence at the surface AB is: **[1]**

(a) 43°   (b) 47°

(c) 90°   (d) 0°

(ii) Select a correct statement from the following. **[1]**

(a) The speed of light at the curved surface AD does not change while entering the block.

(b) The ray at the surface AD is not travelling along the radius of the curved part.

(c) The ray at the surface AD is travelling along the radius of the curved part.

(d) Light never refracts when it enters a curved surface.

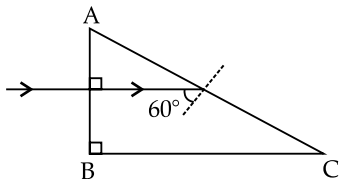(iii) The angle of incidence on the surface BC is: **[1]**

(a) 43°   (b) 47°

(c) 90°   (d) 0°

(iv) The critical angle of this material of glass: **[1]**
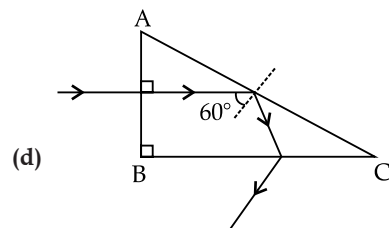
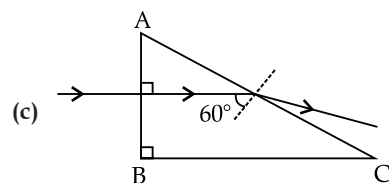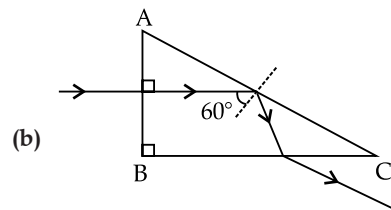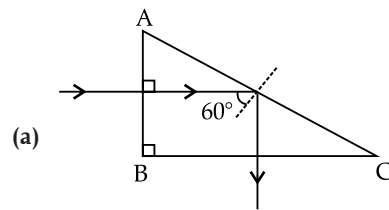(a) 47°   (b) 43°

(c) 42°   (d) 45°

25. The diagram below shows the path of light passing through a right-angled prism of critical angle 42°.

(i) The angle C of the prism is: **[1]**

(a) 45°   (b) 60°

(c) 90°   (d) 30°

(ii) Which one of the following diagrams shows the correct path of this ray till it emerges out of the prism? **[1]**

(a)

(b)

(c)

(d)

ANSWERS

1. Option (b) is correct.

Explanation: $\delta = i + e - A$
i depends on material of medium and colour of light.
A is the angle of prism.
So, deviation (δ) does not depend on the size of prism.

2. Option (c) is correct.

Explanation: $\mu = c/v$
Or, $2.4 = c/v$
∴ $c = 2.4\,v$

3. Option (c) is correct.

Explanation: Concave lens always produces virtual image.

4. Option (a) is correct.

Explanation: The emergent ray will be parallel to the incident ray.

5. Option (c) is correct.

Explanation: Red deviates least since its wavelength is the largest.

6. Option (d) is correct.

7. (i) Option (d) is correct.

Explanation: The lens is convex. If an object is placed in front of a convex lens between F and 2F, a real, inverted and magnified image is formed.

(ii) Option (a) is correct.

Explanation: In hypermetropia, the rays meet beyond the retina. Convex lens is used so that the rays meet in advance i.e. on the retina.

(iii) Option (b) is correct.

Explanation: $1/v - 1/u = 1/f$
Or, $1/v + 1/60 = 1/20$
Or, $1/v = 1/30$
∴ $v = +30$ cm

(iv) Option (c) is correct.

Explanation: Magnification $= v/u = 30/(-60)$
$= -0.5$

8. Option (c) is correct.

Explanation:
SI unit of moment $=$ Nm
CGS unit of moment $=$ dyne cm
1 Nm $= 1$N x 1 m
$= 10^5$ dyne x 10^2 cm
$= 10^7$ dyne cm

9. **Option (c) is correct.**

   Explanation:
   $$W = Fs \cos\theta$$
   Here $\theta = 180°$
   So, the work done $= -Fs$
   ($\cos 180° = -1$)

10. **Option (b) is correct.**

    Explanation: During photosynthesis, plants convert solar energy into glucose. Hence, it is light to chemical energy conversion.

11. **Option (a) is correct.**

    Explanation: When the fulcrum is shifted to 50, the mass of the left side becomes more than the mass of the right hand side. So, the left side of the scale will be tilted down.

12. **(i) Option (b) is correct.**

    Explanation: When a stone is tied at one end of a string and whirled horizontally, the inward force exerted by the string on the stone is called tension. The tension of the string provides the necessary centripetal force for circular motion.

    (ii) Option (a) is correct.

    Explanation: The direction of a centripetal force is towards the center of curvature, the same as the direction of centripetal acceleration.

13. **(i) Option (d) is correct.**

    Explanation: P.E. $= mgh = 200 \times 10^{-3} \times 10 \times 10 = 20$ J

    (ii) Option (b) is correct.

    Explanation: At 15 m height, total energy is potential.
    So, T.E. $= mgh = 200 \times 10^{-3} \times 10 \times 15 = 30$ J
    At 10 m height, potential energy is 20 J.
    So, the rest is kinetic energy.
    So, kinetic energy gain $= 30 - 20 = 10$ J

    (iii) Option (c) is correct.

    Explanation: The total energy of the system is conserved. When the body is just about to touch the ground, the total energy is kinetic. Hence, the total mechanical energy will be 30 J.

    (iv) Option (c) is correct.

    Explanation:
    $$\tfrac{1}{2}mv^2 = 30$$
    Or, $\tfrac{1}{2} \times 200 \times 10^{-3} \times v^2 = 30$
    Or, $v^2 = 300$
    $\therefore \quad v = 10\sqrt{3}$ ms^{-1}

14. **Option (d) is correct.**

    Explanation: Load $= W = mg = 10 \times 10 = 100$ N
    Effort = Force applied = 200 N
    M.A. = Load / effort = 100/200 = 0.5

15. **Option (a) is correct.**

    Explanation: A single fixed pulley though does not reduce the effort but helps in changing the direction of effort applied.

16. **Option (b) is correct.**

    Explanation: If pulley B is moved by x distance downwards, then the rope moves 2x. Hence, the velocity ratio of this arrangement is 2.

17. **Option (d) is correct.**

    Explanation:
    $$E = \tfrac{1}{2}mv^2$$
    or, $dE/dt = \tfrac{1}{2}m \times 2v \times (dv/dt)$
    or, $P = m \times v \times a$
    $\therefore \quad P = F \times v$ (since ma = F)

18. **Option (c) is correct.**

19. **Option (c) is correct.**

20. **(i) Option (b) is correct.**

    Explanation: Since the sound of his whistling coincides with the echo, the reflected sound (*i.e.* the echo) returns to the boy in 0.5 s.

    (ii) Option (d) is correct.

    Explanation: Since the sound of his whistling coincides with the echo, the reflected sound takes 0.5s time to return.
    So, $V = 2D/t$
    Or, $320 = 2D/0.5$
    $\therefore \quad D = 80$ m

    (iii) Option (b) is correct.

    Explanation: Now velocity of sound
    $= V = 320 + 16 = 336$ m/s
    Present distance from wall $= D = 80 + 4 = 84$ m
    $t = 2D/V = 2 \times 84 / 336$
    $= 0.5$ s

    (iv) Option (a) is correct.

    Explanation: To hear an echo time difference should be equal to or more than 0.1 s.

21. **Option (a) is correct.**

    Explanation: Velocity of light in vacuum is same for all wavelengths.

22. **Option (b) is correct.**

    Explanation:
    1 Joule $= 1$ Newton $\times 1$ metre
    And 1 erg $= 1$ dyne $\times 1$ cm
    1 Joule $= 1$ Newton $\times 1$ metre
    Or, 1 Joule $= 10^5$ dynes $\times 10^2$ cm
    $\therefore$ 1 Joule $= 10^7$ erg

23. **(i) Option (b) is correct.**

    Explanation:
    K.E. $= \tfrac{1}{2}mv^2 = \tfrac{1}{2}p^{2/2m}$
    $\therefore$ K.E. $\propto 1/m$
    Since $m_B > m_A$
    K.E.$_A$ > K.E.$_B$

(ii) Option (c) is correct.

Explanation:
$$K.E. \propto 1/m$$
$$\therefore \quad K.E._A/K.E._B = m_B/m_A$$
$$\text{Or,} \quad 5/2 = m_B/m_A$$
$$\therefore \quad m_A/m_B = 2/5$$

24. (i) Option (b) is correct.

Explanation: Angle of incidence is the angle between the incident ray and the normal. Hence, Angle of incidence = $90^0 - 43^0 = 47^0$

(ii) Option (c) is correct.

Explanation: Since the ray is not deviated at AD surface then the ray travels along the radius of the curved part.

(iii) Option (a) is correct.

Explanation: Total internal reflection has occurred at F.
So, $\angle EFB = 43^0$
So, $\angle FEB = 90^0 - 43^0 = 47^0$
So, the angle of incidence at BC surface = $90^0 - 47^0 = 43^0$

(iv) Option (b) is correct.

Explanation: Since for 47^0 angle of incidence total internal reflection has occurred at F, the critical angle is less than this. Also, at surface CB, the incident angle works as critical angle because refracted ray passes from the boundaries of these two media. Hence, the critical angle of the glass will be 43°.

25. (i) Option (d) is correct.
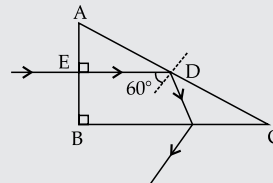
Explanation:

Since angle of incidence > critical angle, total internal reflection will occur at D.
$$\angle ADE = 90^0 - 60^0 = 30^0$$
$$\therefore \quad \angle A = 60^0$$
Now in the triangle ABC,
$$\angle A + \angle B + \angle C = 180^0$$
$$\text{Or,} \quad 60^0 + 90^0 + \angle C = 180^0$$
$$\therefore \quad \angle C = 30^0$$

(ii) Option (b) is correct.

Explanation:
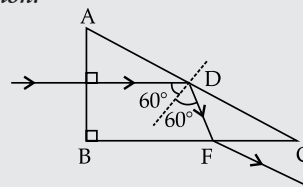
Since angle of incidence > critical angle, total internal reflection will occur at D.
So, the angle of reflection at D is 60^0.
So, the angle of incidence at $F = 120^0 - 90^0 = 30^0$
Since angle of incidence < critical angle, regular refraction will take place.

ICSE SEMESTER-2 EXAMINATION
Physics
Solved Paper - 2021-22
Class-10ᵗʰ

Maximum Marks: 40

Time allowed: One and a half hours

Answers to this paper must be written on the paper provided seperately.

You will not be allowed to write during the first 10 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.

*Attempt **all** questions from **Section A** and **any three** questions from **Section B**.*
The marks intended for questions are given in brackets [ ].

Section-A

(*Attempt **all** questions*)

Q. 1. **Choose the correct answers to the question from the given options. (Do not copy the question. Write the correct answer only.)** **[10]**

(i) Free vibrations are :

    (A) the vibrations under the influence of a periodic force.

    (B) the vibrations with larger amplitude.

    (C) the vibrations when the frequency continuously decreases.

    (D) the vibrations with a constant frequency and constant amplitude.

(ii) The diagram below shows four sound waves. Which sound has the highest pitch?
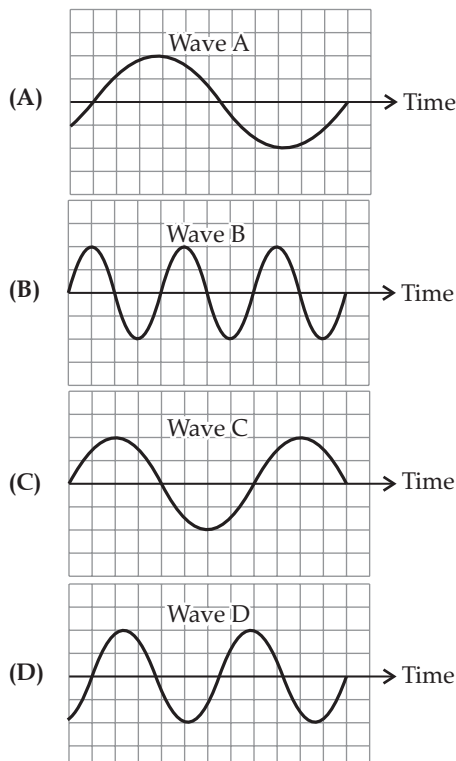
(iii) The graph plotted for potential difference (V) against current (I) for ohmic resistors is :

(A) A curve passing through the origin.

(B) A straight line not passing through origin.

(C) A straight line passing through the origin.

(D) A circle centred at the origin.

(iv) A main switch in the main distribution board is present in :

(A) a live wire   (B) a neutral wire

(C) a live as well as neutral wire   (D) an earth wire

(v) A conductor AB is kept along north south direction of the earth above a magnetic needle as shown below. When the key K is closed then:
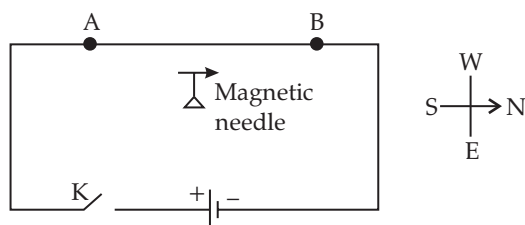
(A) the needle will not show any deflection.

(B) the needle will deflect towards east.

(C) the needle will turn in the opposite direction i.e. towards south.

(D) the needle will deflect towards west.

(vi) A coil wound around a piece of soft iron can become an electromagnetic only when:

(A) the circuit is open.

(B) a magnetic compass is present in the vicinity.

(C) a galvanometer is connected to the circuit.

(D) a current flows in the circuit.

(vii) If water absorbs 4000 joule heat to increase the temperature of 1 kg water through 1°C then the specific heat capacity of water is :

(A) $4\,Jkg^{-1}\,°C^{-1}$ (B) $400\,Jg^{-1}\,°C^{-1}$

(C) $4\,Jg^{-1}\,°C^{-1}$ (D) $4.2\,Jg^{-1}\,°C^{-1}$

(viii) Water is used in car radiators because :

(A) it is a good conductor of heat.

(B) it conducts heat faster as compared to the other substances and cools the engine quickly.

(C) its specific heat capacity is very low.

(D) its specific heat capacity is very high so it can cool the engine without a greater increase in its own temperature.

(ix) The heaviest nuclear radiation is :

(A) x-radiation   (B) α-radiation

(C) γ-radiation   (D) β–radiation

(x) To study the age of excavated material of archaeological significance we study the rate of decay of an isotope of :

(A) Uranium   (B) Cobalt

(C) Carbon   (D) Chlorine

Section-B

(*Attempt **any three** questions from this Section*)

Q. 2. (i) The diagram below shows a magnetic compass kept closer to a coil AB wound around a hollow cylindrical cardboard: [3]
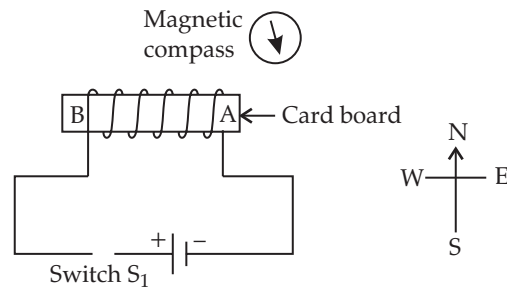
(a) After studying the circuit and the magnetic compass carefully, state whether the switch S_1 is open or closed.

(b) How did you arrive at the conclusion in (a)?

(c) What is the purpose of placing the magnetic compass in the above setup?

(ii) (a) Give an important reason for copper to be used as a material for a calorimeter. **[3]**

(b) Calculate the thermal capacity of 40 g of water.

[Specific heat capacity of water = 4200 $JKg^{-1}\,°C^{-1}$]

(iii)
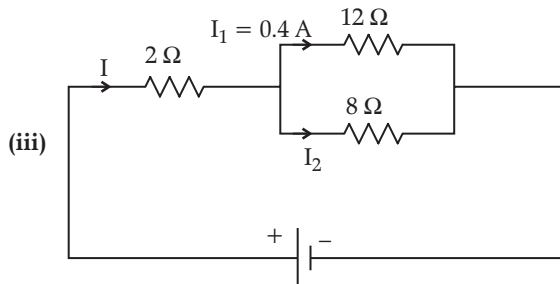
[4]

In the above circuit diagram, calculate:

(a) the external resistance of the circuit

(b) the current I_2

(c) the current I.

Q. 3. (i) Three wires with proper colour coding are connected to the three terminals of a three-pin socket. Match the colour of the wire with the proper terminals A, B and C of the socket. **[3]**

(a) Brown

(b) Green

(c) Light blue

(ii) (a) Why does it become colder after a hailstorm than during or before the hailstorm? **[3]**

(b) 'If two bodies have the same specific heat capacities, then they will always absorb the same amount of heat if their temperature increases by the same amount.' State whether the given statement is true or false.

(iii) A metal piece of mass 420 g present at 80°C is dropped in 80g of water present at 20°C in a calorimeter of mass 84g. If the final temperature of the mixture is 30°C, then calculate the specific heat capacity of the metal piece. **[4]**

[Specific heat capacity of water = 4.2 $Jkg^{-1}\,°C^{-1}$, Specific heat capacity of the calorimeter = 200 $Jkg^{-1}\,°C^{-1}$]

Q. 4. (i) Rohit playing a flute and Anita playing a piano emit sounds of same pitch and loudness. **[3]**

(a) Name one characteristic that is different for waves from the two different instruments.

(b) If now the loudness of the sound from flute becomes four times that of the sound from piano, then write the value of the ratio $A_F : A_P$ (A_F–amplitude of sound wave from flute, A_P – amplitude of sound wave from piano)

(c) Define 'Pitch' of a sound.

(ii) (a) Name two factors on which the force experienced by a conductor carrying current, placed in a magnetic field, depends. Also, state how these factors affect the force. **[3]**

(b) With the help of which rule you can determine the direction of force acting on a current carrying conductor placed in a magnetic field?

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(iii) **(a)** What is nuclear energy? **[4]**

(b) After emission of a nuclear radiation, the atomic number of the daughter nucleus increases by 1. Identify the nuclear radiation.

(c) Write a nuclear reaction indicating the nuclear change mentioned in (b).

(d) What is the special name given to the parent and daughter nucleus when this radiation is emitted?

Q. 5. **(i)** An appliance rated 440 W, 220V is connected across 220V supply. **[3]**

(a) Calculate the maximum current that the appliance can draw.

(b) Calculate the resistance of the appliance.

(ii) **(a)** The diagram below shows a vibrating tuning fork E mounted on a sound box X. When the vibrating tuning forks A, B, C and D are placed on the sound box. Y one by one, it is observed that a louder sound is produced when the tuning fork k. B is place on Y. **[3]**

E

X   Y

A   B   C   D
225Hz   320Hz   384Hz   512Hz
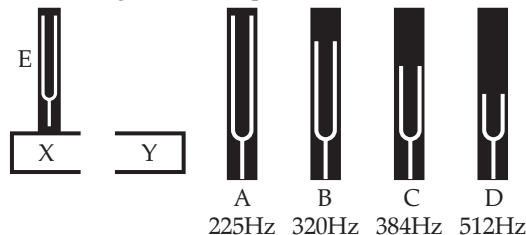
(a) What is the frequency of tuning fork E?

(b) Why does B produce a louder sound?

(iii) **(a)** From the graph of heating curve given below state the melting point and boiling point of the substance. **[4]**
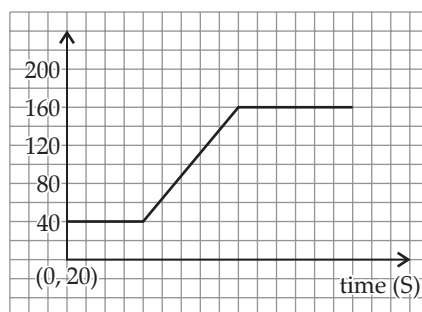
(b) Complete the rewrite of the following nuclear reaction by filling in the blanks.

$^{235}U \rightarrow +_{90}Th + ^4_2He$

Q. 6.
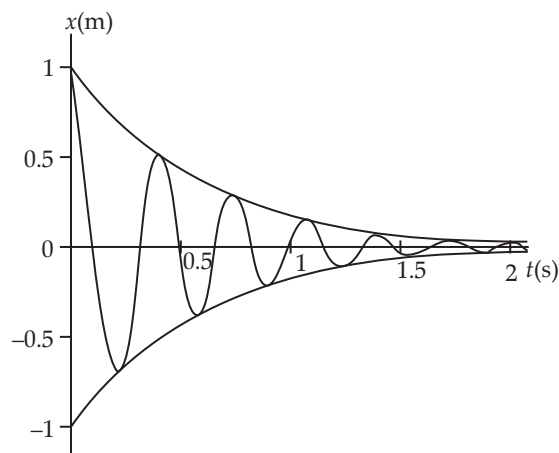
(i) Study the above figure and answer the following : **[3]**

(a) What type of vibration does the above figure represent?

(b) State one reason for which the amplitude of the vibration decreases with time.

(c) Write an example of natural vibrations.

(b) Thermal capacity = specific heat capacity X amount of substance

∴ Thermal capacity of 40g water = 4200 × $\frac{40}{1000}$ = 168 J° C^{-1}

(iii) (a) External resistance of the circuit:

12Ω and 8Ω are in parallel. So the equivalent resistance = $\frac{12 \times 8}{12 + 8}$ = 4.8Ω

2Ω is in series with this combination.

Hence the total resistance = 2 + 4.8 = 6.8Ω

(b) Potential difference across the 12Ω resistor = potential difference across 8Ω resistor

Or, $12 \times 0.4 = 8 \times I_2$

∴ $I_2 = \frac{12 \times 0.4}{8}$ = 0.6A

(c) Current I = $I_1 + I_2$ = 0.4 + 0.6 = 1A

Ans. 3. (i) C is line. Brown coloured wire is to be connected here.

B is neutral. Light blue coloured wire is to be connected here.

C is earth. Green coloured wire is to be connected here.

(ii) (a) After a hailstorm, ice absorbs the heat energy (latent heat) needed for melting from the environment and thus lowering the surrounding temperature.

(b) No. The statement is not true. Amount of heat absorbed depends on the mass of the body also. So, if the masses of the two bodies are different then they will absorb different amounts of heat.

(iii) Mass of metal = 420g

Sp. Heat of metal = S

Temperature = 80°C

Mass of water = 80g

Sp. Heat of water = 4.2 J g^{-1} °C^{-1}

Temperature = 20°C

Mass of calorimeter = 84g

Sp. heat of calorimeter material = 200 J kg^{-1} °C^{-1} = 0.2 J g^{-1} °C^{-1}

Temperature = 20°C

Final temperature of mixture = 30°C

Heat loss by metal = 420 x S x 50 = 21000 S J

Heat gain by water = 80 x 4.2 x 10 = 3360 J

Heat gain by calorimeter = 84 x 0.2 x 10 = 168 J

Since heat lost = heat gained

∴ 21000S = 3360 + 168

∴ S = 0.168 J g^{-1} °C^{-1}

Ans. 4. **(i) (a)** The characteristics is quality.

(b) Loudness (L) is proportional to the square of amplitude (A)

So, $L_F/L_P = A_F^2/A_P^2$

Or, $4/1 = A_F^2 / A_P^2$

∴ $A_F/A_P = 2:1$

(c) Pitch: Sensation of sound is referred to as pitch. High pitch (shrill) sound corresponds to high frequency sound. Low pitch (flat) sound corresponds to low frequency sound.

(ii) (a) Factors acting in a current carrying conductor depend on are strength of magnetic field and strength of current flowing.

Force is directly proportional to the strength of the magnetic field. Force is directly proportional to the strength of the current flowing.

(b) With the help of Fleming's left-hand rule, the direction of force experienced by current carrying conductor placed in a magnetic field can be determined.

Fleming's left hand rule:

If the thumb, first finger and second finger of left hand are held mutually perpendicular to each other then thumb represents the direction force on the conductor. The first finger represents the direction of the magnetic field. The second finger represents the direction of the current.

(iii) (a) Nuclear energy: Nuclear energy is a form of energy released from the nucleus, the core of atoms, made up of protons and neutrons. This source of energy can be produced in two ways: fission – when nuclei of atoms split into several parts or fusion – when nuclei fuse together.

(b) The nuclear radiation is β-radiation.

(c) $_Z^A X \rightarrow _{Z-1}^A Y + _{-1}^0 \beta$
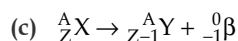
(d) Isobars.

Two atoms of different elements having same mass numbers but different atomic nos. are called isobars. Referring to nuclear reaction of (c), mass numbers of X (parent) and Y (daughter) remain same, but the atomic numbers differ. So, they are isobars.
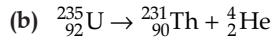
Ans. 5. **(i) (a)** Maximum current drawn = I = W/V = 440/220 = 2A

(b) Resistance of the appliance = R = W/I^2 = 440/2^2 = 110Ω

(ii) (a) Frequency of E is 320 Hz.

(b) B produces large sound since the frequency of B matches with the frequency of E and resonance occurs.

(iii) (a) Melting point is 40°C and boiling point is 100°C.

(b) $^{235}_{92}U \rightarrow \, ^{231}_{90}Th + \, ^4_2He$

Ans. 6. **(i)** **(a)** It is damped vibration.

(b) Reason of decrement of amplitude of vibration is loss of energy due to friction.

(c) Example of natural vibration is an oscillating pendulum.

(ii) **(a)** γ radiation has the maximum speed which is equal to the speeds of light in vacuum.

(b) β particles deviate from their original path.

(c) γ radiation does not deviate at all when passing through a region of electric or magnetic field since it is made of uncharged particles photons.

(iii) **(a)** $$R = \rho \frac{l}{A}$$

When new length becomes $3l$, then new area becomes A/3.

So, $R' = 9\rho \dfrac{l}{A} = 9R = 9 \times 2 = 18\Omega$

(b) Specific resistance remains same since it does not depend on the dimension of the wire. It depends on the material.

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