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ICSE YEAR 2013
PHYSICS
(SCIENCE - PAPER 1)

- **SOLUTION OF 2013**
- **COMMENTS OF COUNCIL EXAMINERS**
- **SUGGESTIONS FOR TEACHERS**

Dedicated to all my lovely students. May God help you always.

This small booklet contains solution of 2013 ICSE Physics (Science Paper 1). The comments from the council examiners under solution of every question makes this a very handy guide for students to understand what the council expects as answer from the students.

I hope that the students will find this to be useful.

Md. Zeeshan Akhtar

23rd February, 2015

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PHYSICS

SCIENCE Paper 1

I.

(a) Give any two effects of a force on a non-rigid body. [2]

(b) One end of a spring is kept fixed while the other end is stretched by a force as shown in the diagram.

(i) Copy the diagram and mark on it the direction of the restoring force.

(ii) Name one instrument which works on the above principle. [2]

(c) (i) Where is the centre of gravity of a uniform ring situated?

(ii) 'The position of the centre of gravity of a body remains unchanged even when the body is deformed.' State whether the statement is ***true*** or ***false***. [2]

(d) A force is applied on a body of mass 20 kg moving with a velocity of 40 ms^{-1}. The body attains a velocity of 50 ms^{-1} in 2 seconds. Calculate the work done by the body. [2]

(e) A type of single pulley is very often used as a machine even though it does not give any gain in mechanical advantage.

(i) Name the type of pulley used.

(ii) For what purpose is such a pulley used? [2]

Examiners' Comments

(a)
- A few candidates related their answers to the change in size or shape, with a few relating it only to the other effects of forces common to both rigid and non-rigid bodies.
- Most candidates answered this question correctly by relating the answer to the change in dimension.

(b)(i)
- Most candidates answered this question correctly
- A few candidates committed errors while drawing diagrams with no proper directions being shown.
- The arrow showing the direction of restoring force was not clearly visible when it was marked on the turns of the spring.

Suggestions for teachers

- Emphasise on the need for reading the question carefully and comprehend the key points required for a suitable answer to be written.
- Explain the difference between rigid body and non rigid body quoting suitable examples.
- The concept of restoring force should be taught with clarity citing additional examples.
- Students should be taught to read the question carefully before writing answers.
- Different colours may be used to highlight the answer.

- A few candidates explained the direction of restoring force that was not part of the question (ii).
- Some candidates wrote the names of playing/common devices containing a spring.
- Many candidates wrote only spring instead of spring balance.

(ii) - Most candidates quoted examples of playing/ common devices containing a spring.
Most candidates wrote the term 'spring' instead of mentioning spring balance.

(c)(i) This question was correctly answered by most candidates.
- A few candidates used incorrect terms such as in the middle, inside the disc etc instead of writing the term geometric centre.
- A few candidates drew sketches that were not part of the question.

(ii) - Most candidates answered the question correctly stating that the statement is false. A few wrote incorrectly by stating the statement was true.
- Most candidates were unable to solve this numerical.

(d) - The candidates who solved the numerical, did so by calculating force and displacement instead of using work energy theorem.
- During the course of solving the numerical, errors were committed in writing units of acceleration and velocity. Unit of work was written as Nm instead of writing the appropriate term 'joule'.
- While calculating force most candidates used g = 10 or 9.8 ms^{-2} instead of calculating the value of acceleration.

(e)(i) Most candidates answered the question correctly while a few wrote incorrect answers and made errors due to confusion over concepts of single fixed pulley and movable pulley.

(ii) Most candidates answered the question correctly stating the use of change in direction. However a few candidates wrote incorrect and vague answers.

Suggestions for teachers

- Students should be made aware that the term 'instrument' implies only a scientific measuring device.
- Students must be advised to read the question thoroughly before attempts are made to answer.
- The difference between middle and centre should be taught with clarity.
- Additional examples may be discussed in length to reinforce concepts.
- Concepts relating to centre of gravity should be thoroughly explained by showing experiments involving change in the distribution of mass results that influence changes in the centre of gravity.
- Factors affecting the position of centre of gravity in a body should be explained intensively.
- Students should be trained to solve numericals using the methods of work energy theorem.
- Students may be advised to practice regularly in order to solve numericals confidently.
- Various alternate methods may be taught in all areas of calculation.
- The difference between concepts of movable and fixed pulley should be explained thoroughly.
- Experimental demonstrations would give clarity and clear doubts.

MARKING SCHEME

Question 1.

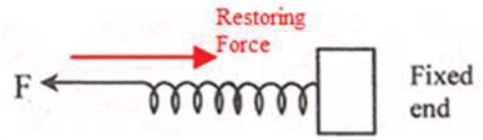
(a) 1. Can change the dimensions of a body

2. Can start or stop the motion of the body.

3. Can change the speed

4. Can change the direction. (Any two points)

(b) (i) Restoring force marked correctly in opposite direction.



(ii) Compression of Spring balance.

(c) (i) At its Geometrical centre.

(ii) False

(d) Work done = ½ m (v^2 - u^2)

= ½ × 20 × 900

= 9000 J

(e) (i) Single fixed pulley.

(ii) To change the direction of effort applied.

Question 2

(a) (i) In what way does an 'Ideal machine' differ from a 'Practical machine'?

(ii) Can a simple machine act as a force multiplier and a speed multiplier at the same time? [2]

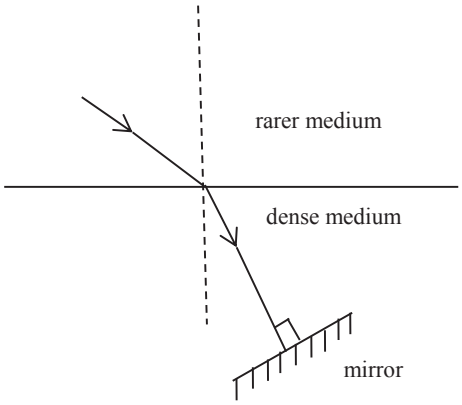
(b) A girl of mass 35 kg climbs up from the first floor of a building at a height 4 m above the ground to the third floor at a height 12 m above the ground. What will be the increase in her gravitational potential energy? (g = 10 ms^{-2}). [2]

(c) Which class of lever found in the human body is being used by a boy –

(i) when he holds a load on the palm of his hand.

(ii) when he raises the weight of his body on his toes? [2]

(d) A ray of light is moving from a rarer medium to a denser medium and strikes a plane mirror placed at 90° to the direction of the ray as shown in the diagram.



(i) Copy the diagram and mark arrows to show the path of the ray of light after it is reflected from the mirror.

(ii) Name the principle you have used to mark the arrows to show the direction of the ray. [2]

(e) (i) The refractive index of glass with respect to air is 1.5. What is the value of the refractive index of air with respect to glass?

(ii) A ray of light is incident as a normal ray on the surface of separation of two different mediums. What is the value of the angle of incidence in this case? [2]

Examiners' Comments

(a) (i) Most candidates answered this question correctly.
A few candidates however related the answer to friction that forms only as one of the factors causing loss of energy.
Most candidates wrote either on Practical machine or Ideal machine without establishing the difference between the two terms.

(ii) Most candidates were unsure about the question and wrote incorrect answers

(b) Most candidates understood the approach to the numerical, however they made calculation, substitution and unit errors.
Some candidates calculated the potential energies separately but added them later on. A few candidates made incorrect observations by writing $g = 10ms^{-2}$ when the question clearly mentioned $g = 9.8ms^{-2}$.

(c) (i) Most candidates answered the question correctly however it was observed that a certain amount of

Suggestions for teachers

- In questions that pose differences to be established, tabular presentations facilitate the understanding of concepts.
- Additional examples may be given to make the learning process easier to comprehend.
- Emphasis should be on manual calculations.
- Adequate practice of numericals must be carried out extensively.
- Correct noting and subsequent usage of data from questions posed must be given due importance during class discussions and practice sessions.

guesswork was carried out by a few candidates due to an element of uncertainty about writing the correct answer.

(ii) Majority of the candidates answered incorrectly with a few candidates writing the correct answer.

(d) (i) Only a few candidates answered the question correctly with many reflecting the path of the reflected ray and not mentioning the incident ray. Arrows on the rays were not marked in appropriate places by a majority of candidates.

(ii) Most candidates were unable to identify the principle of reversibility. Incorrect spelling of principle and other key words were observed in many an answer.

(e) (i) Incorrect symbols were written by a majority of candidates. Refractive index of glass with respect to air was written as ${}_g\mu_a$ and vice versa. Observations include writing direct answers with no calculation and bore no resemblance of establishing the working relationship:

$${}_a\mu_g = \frac{1}{{}_g\mu_a}.$$

(ii) A few candidates wrote $\angle i = 90^0$ that was a common error. Candidates failed to recognise that the angle of incidence is made with the normal and not with the surface.

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Suggestions for teachers

- Students must be trained to identify the position of load, fulcrum and effort by observation and then identify the type. This exercise should be done with different examples taken from daily activities.
- Emphasis on marking the arrows on the ray when direction or medium is changed should be given due importance.
- Students must be guided to keep relevance of the question in mind and avoid ambiguity.
- Instructions must be given to avoid rote learning and extensive practice of diagrams must be done during classroom sessions.
- Concept of principle of reversibility of light should be explained citing more examples.
- All steps to be adopted in the working or functioning of all principles must be explained through regular practice sessions in class.
- Students should be trained to express final answers in decimal as per requirements.
- Meaning of ${}_a\mu_g$ and ${}_g\mu_a$ should be explained clearly and may be used while solving numericals for retention purposes.
- Stress on the fact that the angle of incidence is made with the normal and not with the surface.

MARKING SCHEME

Question 2.

(a)	(i)	Ideal Machine has 100 % efficiency M.A=V.R	Practical Machine has efficiency less than 100% M.A<V.R

Output = Input Output < Input

Anyone point

(ii) No, It will either be acting as a speed multiplier or a force multiplier.

(b) R.E. = m × g × h

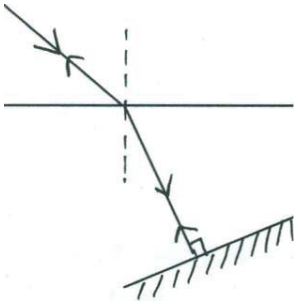
= 35 × 10 × 8

= 2800 J

(c) (i) Class III lever

(ii) Class II lever

(d) (i)



rarer medium

denser medium

mirror

(ii) Principle of reversibility of the path of light

(e) (i) ${}_g\mu_a = \frac{1}{{}_a\mu_g} = \frac{1}{1.5} = 0.67$

(ii) $\angle i = 0^0$ or angle of incidence = 0^0

Question 3

(a) A bucket kept under a running tap is getting filled with water. A person sitting at a distance is able to get an idea when the bucket is about to be filled.

(i) What change takes place in the sound to give this idea?

(ii) What causes the change in the sound? [2]

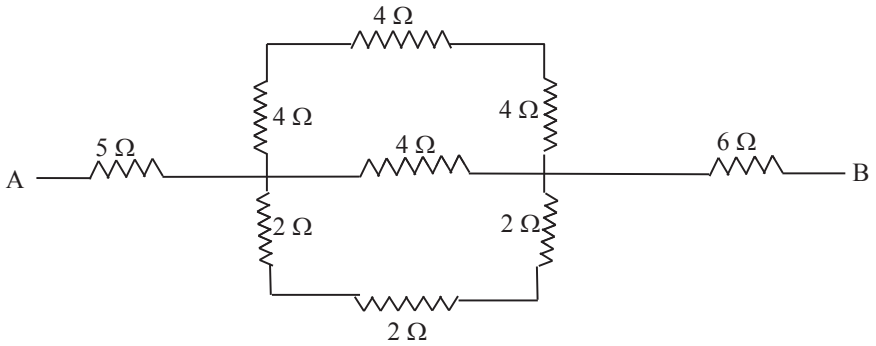
(b) A sound made on the surface of a lake takes 3 s to reach a boatman.

How much time will it take to reach a diver inside the water at the same depth?

Velocity of sound in air =330 ms^{-1}

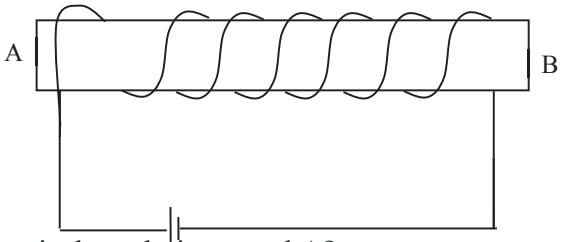
Velocity of sound in water =1450 ms^{-1} [2]

(c) Calculate the equivalent resistance between the points A and B for the following combination of resistors:



[2]

(d) You have been provided with a solenoid AB.



(i) What is the polarity at end A?

(ii) Give *one* advantage of an electromagnet over a permanent magnet. [2]

(e) (i) Name the device used to protect the electric circuits from overloading and short circuits.

(ii) On what effect of electricity does the above device work? [2]

Examiners' Comments

(a) (i) & (ii) A majority of candidates were unable to write the correct answer with a few relating the answer to the resonance in the tube causing increase in amplitude and increase in loudness.
Certain concepts of increase in frequency with the decrease in the length of the air column was missing. A few candidates wrote that frequency changes with the length of air column but failed to write the inverse proportion between them

Suggestions for teachers

- With a tuning fork and an air column in a glass tube; the relation 'length of the air column is inversely proportional to the frequency' should be made clear by means of a demonstration.
- Students should be taught that the formula $v = \frac{2d}{t}$ can be used only when reflection of sound is involved.

(b) A majority of candidates applied V = $\frac{2d}{t}$ when the question does not involve echo or reflection of sound. A few candidates equated $\frac{v \times t}{2}$ for air and water and wrote the correct magnitude but lost marks for the wrong concept applied.

(c) A few candidates attempted to solved the question without writing the left hand side of formula (the subject of formula)

i.e. $\frac{1}{12} + \frac{1}{4} + \frac{1}{6} = \frac{1}{2} = 2\Omega$ Mathematically $\frac{1}{2} \neq 2$.

At every step candidates used the same variable R to calculate resistance with no distinction being shown. Omission of important steps and working of parallel combination was not shown hence it led to an under performance by a few candidates.

(d) (i) Most candidates answered this question correctly with a few writing answers based on guess work.

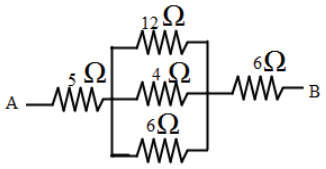
(ii) Most candidates answered this question correctly.

(e) Majority of candidates wrote the devices correctly but failed to identify the principle on which it works. E.g. they wrote MCB but could not identify the principle 'magnetic effect of current.' and in some cases they wrote 'heating effect of current' as principle of MCB.

Many candidates wrote fuse and how it helps in protecting the circuit yet failed to mention the physical term 'heating effect of current'.

Suggestions for teachers

- Concepts relating to reflection of sound, should be explained comprehensively through additional practice of numericals.
- Initially emphasise that students should go on simplifying the diagram after every step of calculation. For eg after showing the calculation of series combination, the diagram can be drawn as



- Extensive practice of numericals involving series and parallel combination should be carried out.
- Correct methodology of working should be emphasised giving due importance on showing the significant steps involved and not merely writing the final correct answer.
- This concept may be clarified by way of a practical demonstration.
- Discussions on various forms of examples by changing the current and direction of turnings of the coil may be undertaken.
- Additional practice through demo based lessons can be carried out during classroom sessions.
- The different electrical components need to be discussed in the class with the principle on how they function through open house discussions and practical demonstrations.
- A small wooden board with wiring and fittings of different electrical components can be made in the laboratory and be used for demonstration purposes.

MARKING SCHEME
Question 3.

(a) (i) The sound becomes shriller and shriller / the pitch of sound increases.

(ii) As the level of water in the bucket increases, the length of the air column above it decreases so the frequency of pitch of the sound increases.

(b) distance = speed x time

= 330 x 3 = 990 m

Time taken in water = 990/ 1450

= 0.68 S

(c) R =4 + 4 + 4 = 12 Ω R' = 2 + 2+ 2 = 6 Ω

1/ R" = 1/ 12 +1/4 +1/6

R" = 2 Ω

Equivalent resistance = 5 + 2 + 6 =13 Ω

(d) (i) North pole

(ii) Polarity can be reversed / can be demagnetized / strength can be changed. (any one)

(e) (i) Fuse

(ii) Heating effect of current.

Question 4

(a) Define the term 'Heat capacity' and state its S.I unit. [2]

(b) What is meant by Global warming? [2]

(c) How much heat energy is released when 5 g of water at 20 °C changes to ice at O °C?

[Specific heat capacity of water = 4.2 J g^{-1} $°C^{-1}$

Specific latent heat of fusion of ice = 336 J g^{-1}] [2]

(d) Which of the radioactive radiations -

(i) can cause severe genetical disorders.

(ii) are deflected by an electric field? [2]

(e) A radioactive nucleus undergoes a series of decays according to the sequence

$$X \xrightarrow{\beta} X_1 \xrightarrow{\alpha} X_2 \xrightarrow{\alpha} X_3 .$$

If the mass number and atomic number of X_3 are 172 and 69 respectively, what is the mass number and atomic number of X? [2]

Examiners' Comments

(a) Most candidates answered the question correctly. However a few only wrote the definition with no mention of the unit of the specific heat capacity while others committed errors in writing the unit of the specific heat capacity.

(b) Most candidates wrote correctly yet failed to frame the answer in accordance to what the question demanded. Instead of writing the average temperature of the earth few candidates wrote temperature of the earth or the atmosphere instead. A majority of candidates wrote the impact of global warming such as melting of glaciers, increase in the sea level instead of writing the definition of global warming.

(c) Most candidates answered the first part of the question correctly however a few committed conceptual errors while answering the second part of the question.

(d) Most candidates answered the first part of the question correctly however a few candidates committed conceptual errors while answering the second part of the question.

(e) Most candidates answered the question correctly, however a few candidates were unable to apply the concerned law correctly that required a number of stages and in reverse order.

Suggestions for teachers

- Highlight the difference between heat capacity and specific heat capacity, and make students aware that the sp. Heat cap definition or unit is mentioned in place of heat capacity because sp. heat capacity is more commonly used in every numerical.
- A correct framing of answers needs to be emphasized upon where definitions and meanings of terms asked for need to be highlighted.
- Rote learning should be avoided and encourage students to satisfy their queries during discussions in class.
- Concepts relating to latent heat and the change of phase, to be explained thoroughly followed by extensive practice of numericals.
- It is important for clarity in concepts relating to gamma radiations not being termed as particles.
- Rutherford and Soddy's laws need to be explained thoroughly.
- Additional practice needs to be given to complete the nuclear equations over more stages of reaction and in reverse order too.

MARKING SCHEME
Question 4.

(a) The heat capacity of a substance is the amount of heat energy required to raise the temperature of that substance through 1 K.
$J\ K^{-1}$ or $J\ °C^{-1}$.

(b) Global warming means the increase in the average effective temperature of earth's surface due to an increase in the amount of green house gases in its atmosphere.

(c) $Q = mc\theta + mL \quad Q = 5 \times 4.2 \times 20 + 5 \times 336$
$= 420 + 1680$
$= 2100J$

(d) (1) gamma radiations
(2) alpha and beta radiations.

(e) Mass number of X =180
Atomic number of X = 72.

Question 5

(a) (i) With reference to their direction of action, how does a centripetal force differ from a centrifugal force?

(ii) State the Principle of conservation of energy.

(iii) Name the form of energy which a body may possess even when it is not in motion. [3]

(b) A coolie is pushing a box weighing 1500 N up an inclined plane 7.5 m long on to a platform, 2.5 m above the ground.

(i) Calculate the mechanical advantage of the inclined plane.

(ii) Calculate the effort applied by the coolie.

(iii) In actual practice, the coolie needs to apply more effort than what is calculated. Give one reason why you think the coolie needs to apply more effort. [3]

(c) A block and tackle system of pulleys has a velocity ratio 4.

(i) Draw a labelled diagram of the system indicating clearly the points of application and directions of load and effort.

(ii) What is the value of the mechanical advantage of the given pulley system if it is an ideal pulley system? [4]

Examiners' Comments

(a) (i) Majority of candidates were unable to justify their answers and lacked expression. A few candidates mentioned that the centripetal force is towards the centre of the circle and centrifugal force away from centre of the circle instead of writing centre of circular path of motion.

(ii) Most candidates answered this question correctly. However a few committed errors due to lack of expression and flaws in language skills.

(iii) A few candidates failed to comprehend the question and wrote incorrect answers due to lack of understanding of the basic concepts related to the topic.

(b) Most candidates answered this question correctly. Some of them used relation Load × Load arm = Effort × Effort arm to calculate effort and then used M.A. = $\frac{L}{E}$. They did not realise the relation

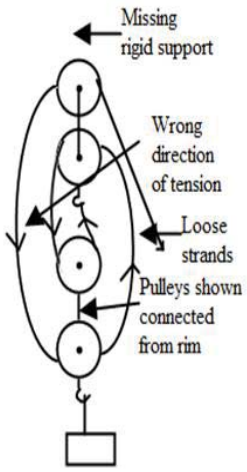
Suggestions for teachers

- Centripetal and centrifugal force must be clearly explained with a demonstration of a simple thread and stone or by asking two students to hold each other's hands while facing each other and leaning backwards and moving in a circle.
- Emphasis must be laid on correctness of language/right terminology to be used in answering correctly.
- Instruct students to focus on important concepts taught in class to enable them to write effective answers. Probable errors that surface may be discussed to avoid their repetition in the future.

Load × Load arm = Effort × Effort arm is applicable only to levers thus conceptually it becomes wrong even though the answer is correct. A few candidates were unable to answer the third part of the question relating to frictional force of the surface.

(c) Most candidates scored poorly due to making of rough sketches. No rigid support was shown. In some cases pulleys were shown to be connected from the rim and not from the centre. Even in some cases, the hook to suspend the load or connecting the two blocks was shown from the rim.

Strands were not shown under tension but were shown loose. Incorrect direction of tension and in some cases direction of Load and effort was missing. Errors are shown in the adjacent diagram.



The second part of the question was correctly answered by most candidates.

Suggestions for teachers

- Proper mathematical skills should be developed by practising more numericals.
- Additional practice is needed in solving numericals of inclined plane.
- Students should also know that M.A. = $\frac{l}{h}$ is applicable to inclined plane in an ideal case.
- Emphasise the need and importance of using diagrams that can be practiced during class discussions and later through home assignments.
- Regular periodic practice should be given in making diagrams with various velocity ratios.

MARKING SCHEME
Question 5.

(a) (i) Centripetal force is a force directed towards the centre of circle at each point.
Centrifugal force is force acting away from the centre of the circular path.

(ii) Energy can neither be created nor can it be destroyed. It only changes from one form to another. The sum total of energy in the universe always remains the same.

(iii) Potential energy.

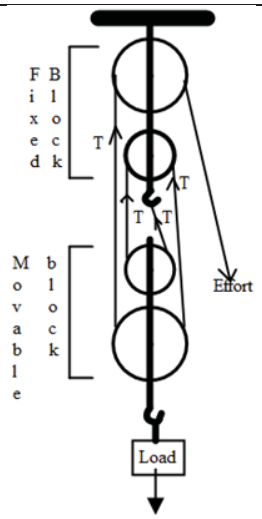
(b) (i) M.A = I/h =7.5/2.5 =3

(ii) M.A = Load / Effort 3 = 1500 / Effort

Effort = 500 N

(iii) More effort is required to overcome the friction between the box and the surface of inclined plane.

(c) (i) Correct diagram drawn with proper arrangement of 4 pulleys, load and effort



(ii) M.A = 4

Question 6

(a) Name the radiations:

(i) that are used for photography at night.

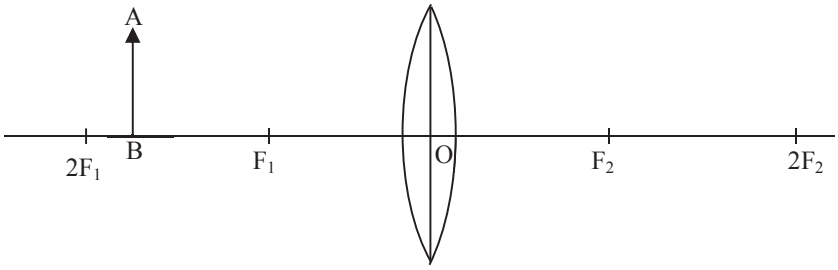
(ii) used for detection of fracture in bones.

(iii) whose wavelength range is from 100 Å to 4000 Å (or 10 nm to 400 nm). [3]

(b) (i) Can the absolute refractive index of a medium be less than one?

(ii) A coin placed at the bottom of a beaker appears to be raised by 4.0 cm. If the refractive index of water is 4/3, find the depth of the water in the beaker. [3]

(c) An object AB is placed between $2F_1$ and F_1 on the principal axis of a convex lens as shown in the diagram:



Copy the diagram and using three rays starting from point A, obtain the image of the object formed by the lens. [4]

Examiners' Comments

(a) Most candidates answered the question correctly. However a few candidates used IR for infra red radiations which is not the standard abbreviation. While others appeared confused between the uses of infra red and ultra violet radiations.

(b) (i) A few candidates wrote the correct answer by simply stating "yes' however it was more of guesswork on their part.

(ii) 'Appears to be raised', was interpreted as apparent depth by a few candidates while others did not write the unit for final answer.

(c) Most candidates were unable to draw the third ray correctly. Some candidates used the logic that rays coming from the same point after refraction through the lens meet at the same point. After drawing two correct rays they randomly showed third ray incident at any point on the lens and joined it to the same point of intersection of the first two rays. Candidates must understand that if they draw this random ray first then its path cannot be completed independently (i.e. without taking the help of other rays).

Many candidates failed to mark the arrows on the rays before and after refraction.

Many candidates were found wanting in their answers as they did not mark F and 2F at equidistance on either side. Hence, the object position was wrong and the image which was obtained had wrong characteristics.

Suggestions for teachers

- Students should be instructed to avoid the use of abbreviations and write the complete form.
- Comparative properties, uses and wavelength of radiations need to be discussed with students regularly and revision must be carried out periodically.
- It should be made clear to students that in no medium, light travels faster than sound therefore in the relation $\mu = \frac{speed\ of\ light\ in\ vacuum}{speed\ of\ light\ in\ the\ medium}$ the denominator is always less than the numerator and hence absolute refractive index can never be less than 1.
- Additional practice should be given in solving numericals.
- Should emphasise on careful reading and writing the data before solving the numerical.
- While teaching diagrams on rays in the class it should be taught using three rays.
- Insist on the completion of technicalities of the diagram. i.e. same distance between F and 2F, arrows before and after refraction etc.

MARKING SCHEME

Question 6.

(a) (i) Infra-red radiations.

(ii) X rays

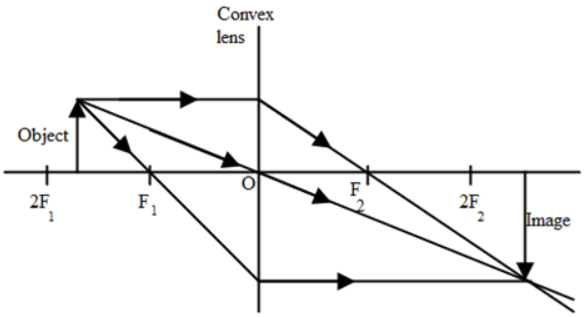
(iii) Ultraviolet radiations.

(b) (i) No, because refractive index = C / V and C is always greater than V therefore refractive index > 1

(ii) μ = Real depth/Apparent depth

$4/3 = \frac{x}{x-4}$ x = 16 cm.

(c)



A ray shown parallel to the principal axis and passing through F_2,
A ray shown passing through optical centre and moving undeviated.
A ray shown passing through Fi and moving parallel to the principal axis. Image shown correctly.

Question 7

(a) (i) What is the principle on which SONAR is based?

(ii) An observer stands at a certain distance away from a cliff and produces a loud sound. He hears the echo of the sound after 1.8 s. Calculate the distance between the cliff and the observer if the velocity of sound in air is 340 ms^{-1}. [3]

(b) A vibrating tuning fork is placed over the mouth of a burette filled with water. The tap of the burette is opened and the water level gradually starts falling. It is found that the sound from the tuning fork becomes very loud for a particular length of the water column.

(i) Name the phenomenon taking place when this happens.

(ii) Why does the sound become very loud for this length of the water column? [3]

(c) (i) What is meant by the terms (1) amplitude (2) frequency, of a wave?

(ii) Explain why stringed musical instruments, like the guitar, are provided with a hollow box. [4]

Examiners' Comments

(a) (i) Most candidates stated what SONAR stood for rather than writing its principle.

(ii) A majority of candidates correctly solved the numerical, however a few candidates failed to mention the unit of the final answer which displayed a sense of carelessness and applied $v = \frac{d}{t}$ instead of $= \frac{2d}{t}$.

(b) Most candidates identified the phenomenon and answered correctly, however a few minor details were not mentioned in the answer. For e.g., a few candidates made no attempt to mention that the increase in amplitude is due to resonance that causes the increase in loudness.

(c) Most candidates were unable to score as they wrote definitions with reference to vibrating pendulum and not wave particle or particle of medium.In the definition of amplitude, the word maximum was missing for displacement.

Many candidates related their answers to the resonance rather than the surface area of the hollow sound box.

Suggestions for teachers

- Emphasise that the principle of SONAR is 'Principle of reflection of Ultrasonic waves'.
- Assign additional practice of numericals involving the application of $v = \frac{d}{t}$ and $v = \frac{2d}{t}$ in the same sum thus making it clear that $v = \frac{2d}{t}$ can be applied only if reflection of sound wave is involved.
- This concept needs to be dealt through simple demonstrations showing resonance in air column.
- Key points related to the phenomenon of resonance such as natural frequency, increase in amplitude should be explained on a regular basis.
- Stress must be laid on definitions of the terms such as amplitude, frequency and related terms with respect to a wave.
- The primary reason of having a sound box for a stringed musical instrument is a larger surface area. This should be made clear to students by using simple demonstration with a vibrating tuning fork touching a table surface. Explain how energy transmitted to more air particles helps in increasing the loudness.

MARKING SCHEME

Question 7.

(a) (i) principle of echo.

(ii) V = 2 distance / time

Distance = (340 x 1.8)/2

= 306 m.

(b) (i) Resonance

(ii) This happens because the frequency of the tuning fork becomes equal to the natural frequency of the vibrating air column, therefore air particles start vibrating with greater amplitude.

(c) (i) (1) Amplitude is the maximum displacement of a wave particle from its mean positio

(2) Frequency is the number of waves passing a point in one second's time.

(ii) The vibrating strings cause the air in the hollow box to undergo forced vibrations. The large surface area of the box causes more air to vibrate producing a louder sound

Question 8

(a) (i) It is observed that the temperature of the surroundings starts falling when the ice in a frozen lake starts melting. Give a reason for the observation.

(ii) How is the heat capacity of the body related to its specific heat capacity? [3]

(b) (i) Why does a bottle of soft drink cool faster when surrounded by ice cubes than by ice cold water, both at 0° C?

(ii) A certain amount of heat Q will warm 1 g of material X by 3° C and 1 g of material Y by 4° C. Which material has a higher specific heat capacity? [3]

(c) A calorimeter of mass 50 g and specific heat capacity 0.42 J g^{-1} $°C^{-1}$ contains some mass of water at 20° C. A metal piece of mass 20 g at 100 °C is dropped into the calorimeter. After stirring, the final temperature of the mixture is found to be 22° C. Find the mass of water used in the calorimeter.

[specific heat capacity of the metal piece = 0.3 J g^{-1} $°C^{-1}$

[specific heat capacity of water = 4.2 J g^{-1} $°C^{-1}$] [4]

Examiners' Comments

(a) Most candidates scored poorly as they only wrote about heat being absorbed by ice to melt, but failed to mention the surrounding or large quantity of heat. A few candidates even wrote that ice on melting gives out heat.
In the second part of the question the symbols C and C' were not used correctly. They wrote C = m C'.
Many candidates were unaware of the relation Heat capacity = mass × specific heat capacity with a few differentiating between heat capacity and specific heat capacity.

(b) A few candidates were confused in their expression and inadvertently missed out on the word extra heat absorbed during the process of melting.

Suggestions for teachers

- Students should be trained to cover all relevant points assigning reasons for the same.
- Topics must cover certain basic and key points related to the terms and their explanation.
- The difference between heat capacity and specific heat capacity should be explained and their mathematical relation should be explained thoroughly.

Many candidates however answered this part correctly, while others answered incorrectly as they could not understand the inverse proportion between specific heat capacity and rise in temperature for same mass and for same amount of heat supplied.

(c) Most candidates committed errors while solving this numerical with many being unable to form an equation.
A few candidates wrote the correct equation but committed errors in substitution or in calculations.
In many cases the final answer was written as 50 g rather than expressing it in terms of a decimal.

Suggestions for teachers

- Instruct and guide students to focus on the requirements of the question and write answers as per requirement.
- Topics must be made clear as to how factors related to heat are absorbed or released when some factors are kept constant.
- Advise students on issues concerning equations where the type of numerical should be identified, as suggested in Q4 C, then write the data in proper units and finally attempt to solve the sum.

MARKING SCHEME

Question 8.

(a) (i) When ice melts it draws latent heat (336 J g^{-1}) from the surroundings. This results in a lowering of temperature.

(ii) Heat capacity = mass x specific heat capacity.

(b) (i) Cubes of ice at 0°C will absorb additional heat in the form of latent heat to melt (1) to water at 0°C which ice cold water at 0°C will not absorb.

(ii) Material Y

(c) $m_s, c_s, \theta_s = m_w C_w \theta_w + m_c C_c \theta_c$

$20 \times 0.3 \times 78 = m_w \times 4.2 \times 2 + 50 \times 0.42 \times 2$

$8.4\ m = 426$

$m = 50.7$ g

Question 9

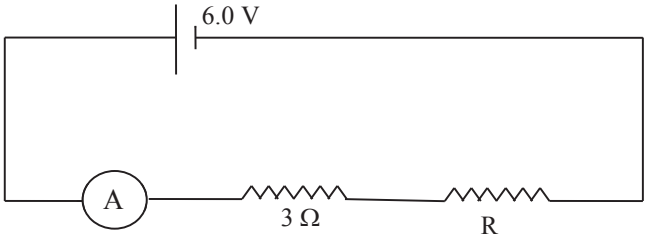
(a) (i) State Ohm's law.

(ii) A metal wire of resistance 6 Ω is stretched so that its length is increased to twice its original length. Calculate its new resistance. [3]

(b) (i) An electrical gadget can give an electric shock to its user under certain circumstances. Mention any two of these circumstances.

(ii) What preventive measure provided in a gadget can protect a person from an electric shock? [3]

(c) The figure shows a circuit



When the circuit is switched on, the ammeter reads 0.5 A.

(i) Calculate the value of the unknown resistor R.

(ii) Calculate the charge passing through the 3 Ω resistor in 120 s.

(iii) Calculate the power dissipated in the 3 Ω resistor. [4]

Examiners' Comments

(a) A few candidates failed to mention 'the temperature or physical conditions remaining constant' in the statement of Ohm's law while others wrote potential difference is directly proportional to the current instead of vice versa.
In the numerical most candidates seemed unaware that stretching the wire not only doubles the length but halves the cross sectional area too. They just doubled the resistance. Double resistance due to halving of cross sectional area was not calculated.
In a few cases direct answers were written with no working of the numerical.

(b) Most candidates made no mention of the important point about earthing being absent and stated situations where the ultimate meaning was the same as a live wire coming in contact with the body of the appliance or the body of the person touching the appliance.
In the second part of the question many candidates wrote the correct answer barring a few who wrote fuse instead of the term earthing.

(c) Most candidates answered the first part of the question correctly but committed errors in in the 2nd and 3rd part of the question with a few using $P = \frac{V^2}{R}$ and then used V = 6 V.

Suggestions for teachers

- All topics concerning laws need to be explained and expressed as per existing facts.
- Factors related to the resistance need to be discussed with the help of numericals.
- When the wire is stretched or folded it may be expressed with the help of a direct formula 'New Resistance = x^2 × initial resistance'
  Where x = the number of times the wire is stretched or folded on itself.
- It should be made clear to students, that all circumstances of getting an electric shock can be classified as:
  - Circuit completing through the body of the person handling the appliance.
  - Absence of earthing.
  - Voltage fluctuations, inducing current in the metallic part of the body.
- Regular practice of different types of numericals must be carried out in class.
- The concept that the voltage splits up in direct proportion with the resistance in series combination of resistors and current in series combination of resistances remains the same, should be made amply clear to the students.

MARKING SCHEME

Question 9.

(a) (i) Correct statement of Ohm's law.

(ii) $R = \rho\ I\ I\ a \rightarrow \rho = 6\ a\ I\ I$

$R_1 = \rho\ 2\ l\ I\ a/2$

$R_1 = \rho\ 4\ 1/\ a \rightarrow R_1 = 24\ \Omega$

(b) (i) 1. The live wire comes in contact with a person's body

2. The body of the appliance is not properly earthed.

(ii) Earthing of the appliance.

(c) (i) $I = V/R$

$0.5 = \frac{6}{3+R}$

$R = 9\ \Omega.$

(ii) $Q = I\ x\ t$

$Q = 0.5 \times 120 = 60\ C$

(iii) $P = I^2 R$

$= 0.5 \times 0.5 \times 3 = 0.75\ W.$

Question 10

(a) Name the *three* main parts of a Cathode Ray Tube. [3]

(b) (i) What is meant by Radioactivity?

(ii) What is meant by nuclear waste?

(iii) Suggest *one* effective way for the safe disposal of nuclear waste. [3]

(c) (i) Draw a simple labelled diagram of a d.c. electric motor.

(ii) What is the function of the split rings in a d.c. motor?

(iii) State *one* advantage of a.c. over d.c. [4]

Examiners' Comments

(a) Most candidates answered this question correctly barring a few who made spelling errors.

(b) Important key words such as spontaneously and nucleus were absent in the definition in the answers of most candidates.
Many candidates were unaware about the term nuclear waste and wrote incorrect answers that had no clarity.
In the third part of the question many candidates mentioned 'away from residential area' but failed to mention 'buried underground' with some even stating dumped on the ground.

(c) Most candidates drew wrong and non-functional diagrams with the following observations:
* Slip rings were drawn instead of split rings.
* Battery was missing.
* Carbon brushes were missing.

Many candidates failed to write the function of split rings. In some cases, to change the direction of current was mentioned but failed to state after every 180^0 rotation.

Most candidates were not clear of the advantages of A.C. over D.C. They wrote vague answers like A.C. changes direction so it is better than D.C.

Suggestions for teachers

- Emphasis should be made to correctly write terms associated with concerned topics.
- This topic needs to be discussed with students rather than giving them for self-study.
- Students need to be given sufficient practice in drawing diagrams.
- Explain the difference between D.C. motor and A.C. generator clearly in particular the commutator system in both.
- The basic advantage of A.C. over D.C. during the transmission of power needs to be explained clearly to students.

MARKING SCHEME

Question 10.

(a) 1. Electron gun.

2. Deflecting system.

3. Fluorescent screen.

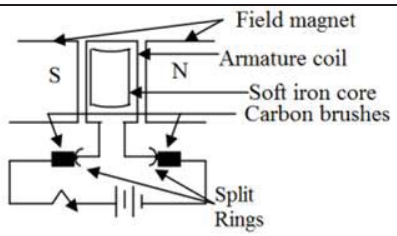
(b) (i) The spontaneous emission of alpha, beta and gamma radiations from the nucleus of an atom.

(ii) The radioactive material after its use is known as nuclear waste.
released in the form of gamma radiations.

(iii) Should be kept in thick casks and buried in specially constructed deep underground stores.

(c) (i) Labelled diagram of d.c. motor

(ii) The split rings reverse the direction of current in the coil after every half a turn.



(iii) The voltage of a.c. can be altered but that of d.c. cannot.

Topics/Concepts found difficult or confusing

- Application of work – energy theorem.
- Function of a machine as speed multiplier and force multiplier not possible simultaneously.
- Vibrations in an air column.
- Working of M.C.B.
- Heat numericals.
- Diagrams of pulley systems.
- Inclined plane numericals.
- Drawing of ray diagram using three rays.
- Definitions of the terms related to a wave and loudness of stringed musical instruments.
- Numericals of electricity especially involving relation $\frac{R_1A_1}{l_1} = \frac{R_2A_2}{l_2}$.
- Reasons for getting an electric shock.
- Diagram of D.C. motor.

Suggestions for the students

- Use the reading time of 15 minutes judiciously to make a proper choice of questions from section II by reading the requirements of the question carefully supported with a high level of concentration.
- Avoid writing answers which are simply a repetition of the question instead be specific about the key word in that statement.
- Students must not leave any topic for option. All topics are covered in section I which is compulsory.
- Avoid changing the order of sequence of questions and numbering system.
- Handwriting should be neat and legible .
- Learn the principles, laws and definitions accurately.
- Ray diagrams and the other diagrams need to be practiced periodically.
- While writing answers it not only important to cover all relevant points but to present them in a proper sequence.
- While solving a numerical it is advisable that the formula needs to be written in the beginning. Essential steps need to be shown and final answer needs to be expressed along with a proper unit. Avoid computation at the first step; let it be plain substitution as the marks are awarded for correct substitution.
- Be regular in your study habits. Complete your syllabus well in time. A thorough revision of all topics is all time important.
- It is advisable to solve previous year's papers in writing.
- More emphasis should be given on writing rather than on memorising.
- For speed in mathematical calculations; it is advisable to learn tables up to 30, know squares up to 30, cubes up to 15 and basics of fractions and decimal.