QUALITATIVE ANALYSIS

PHYSICS (SCIENCE PAPER-I)

SECTION I (40 Marks)

Attempt all questions from this Section

Question 1

(a) A brass ball is hanging from a stiff cotton thread. Draw a neat labelled diagram showing the forces acting on the brass ball and the cotton thread. [2]

(b) The distance between two bodies is doubled. How is the magnitude of gravitational force between them affected? [2]

(c) Why is a jack screw provided with a long arm? [2]

(d) If the power of a motor be 100 kW, at what speed can it raise a load of 50,000 N? [2]

(e) Which class of lever will always have MA > 1 and why? [2]

Comments of Examiners

(a) Most of the candidates drew a ball and the string properly but following errors were observed:
- – Labelling was missing.
- – Directions were not drawn.
- – Support was missing.
- – A few candidates drew a spring in place of a string.

(b) Many candidates identified that "it decreases" but failed to identify the inverse square relation involved.

(c) Many candidates just wrote "as force multiplier". Very few explained with the inverse proportion between force and effort arm.

(d) Many candidates failed to convert kW to W. Some wrote the unit of speed as ms^{-2} instead of $m\ s^{-1}$.

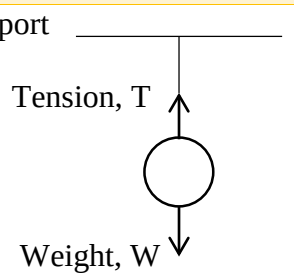
(e) Some candidates did not understand the meaning of the word 'always' and mentioned the class of lever as 1. Most candidates wrote E.A.> L.A. but did not mention that load lies between the fulcrum and the effort.

Suggestions for teachers

- Give more practice in drawing diagrams with labelling Also, give inputs to students on the mistakes made by them.
- While explaining the relation between various quantities, emphasise the mathematical proportion rather than just saying that one quantity increases then the other decreases or vice versa.
- Advise students to practice conversion of one type of unit into another.
- Train students to understand as to what is exactly asked in the question.
- Make it clear to students that the increase or decrease of effort and load arm does not depend on the class of lever.

MARKING SCHEME

Question 1

(a)	(i) Support 
(b)	$F \propto \frac{1}{d^2}$ where F: force, d: distance between centres. F becomes $\frac{1}{4}^{th}$ of the initial force.
(c)	Increase in torque arm, increases the moment of force, so, lesser effort is required for turning.
(d)	$v = \frac{P}{F} = \frac{100 \times 1000}{50000}$ $v = 2m\ s^{-1}$
(e)	Class II As effort arm will **always** be greater than the load arm.

Question 2

(a) Define heat capacity and state its SI unit. [2]

(b) Why is the base of a cooking pan generally made thick? [2]

(c) A solid of mass 50 g at 150°C is placed in 100 g of water at 11°C, when the final temperature recorded is 20°C. Find the specific heat capacity of the solid. [2]

(Specific heat capacity of water = 4.2 J/g°C)

How is the refractive index of a material related to? [2]

(d) (i) real and apparent depth?

(ii) velocity of light in vacuum or air and the velocity of light in a given medium?

(e) State the conditions required for total internal reflection of light to take place. [2]

Comments of Examiners

(a) Many candidates wrote the definition of heat capacity correctly but some of them confused it with the definition of specific heat capacity and the same was observed with the unit. It was also observed that some students wrote ^{0}K which is the incorrect way of expressing the unit of temperature.

(b) Most of the candidates answered one point correctly but did not write about the key point, increase in heat capacity.

(c) Many candidates attempted this numerical correctly but some made mistakes in framing the equation, in substituting the values for temperature and in calculation.

(d) Most candidates answered this question correctly. Some wrote about direct proportion but failed to write about inverse proportion in both the parts.

(e) Most of the candidates expressed the conditions required for total internal reflection of light to take place correctly. However, others made the following errors: Only one condition was given.

- Some wrote that light enters from rarer medium to denser medium.
- Instead of angle of incidence being greater than critical angle, it was written vice versa and some wrote incident "ray greater than critical angle".

Suggestions for teachers

- Difference between specific heat capacity and heat capacity should be explained clearly. Written practice of definitions needs to be emphasised.
- Stress on kelvin as SI unit of temperature and to be used in derived units also.
- A variety of numericals need to be practised with emphasis on answers being in decimal.
- Train the students to answer as per the question asked and to cover all required points.
- Due to rote learning students, often do not realise that the statement written by them does not convey the correct meaning if they miss a single word or some information. Hence, make the students aware of the probable errors which they make.

MARKING SCHEME

Question 2

(a)	The amount of heat required to raise the temperature of the given mass of the body by 1^0C. SI unit of heat capacity is J/K or J K^{-1}.
(b)	To raise its thermal capacity; so that it imparts sufficient heat at low temperature to food. Moreover, it keeps the food warmer for a longer time after cooking.
(c)	Heat given by solid = Heat taken by water $50 \times c \times 130 = 100 \times 4.2 \times 9$ $c = \frac{100 \times 4.2 \times 9}{50 \times 130} = 0.58$ J/g ^{o}C
(d)	(i) Refractive Index = $\frac{Real\ Depth}{Apparent\ Depth}$

	(ii) Refractive Index = $\frac{Velocity\ of\ light\ in\ air\ or\ vacuum}{Velocity\ of\ light\ in\ the\ given\ medium}$
(e)	Light ray should travel from a denser to a rarer medium. Angle of incidence($\angle$ i) should be greater than the critical angle($\angle$ i_c).

Question 3

(a) Draw a ray diagram to show the refraction of a monochromatic ray through a prism when it suffers minimum deviation. [2]

(b) The human ear can detect continuous sounds in the frequency range from 20 Hz to 20,000 Hz. Assuming that the speed of sound in air is 330 ms^{-1} for all frequencies, calculate the wavelengths corresponding to the given extreme frequencies of the audible range. [2]

(c) An enemy plane is at a distance of 300 km from a radar. In how much time the radar will be able to detect the plane? Take velocity of radio waves as 3 x 10^8 m s^{-1}. [2]

(d) How is the frequency of a stretched string related to: [2]

(i) its length?

(ii) its tension? [2]

(e) Define specific resistance and state its SI unit.

Comments of Examiners

(a) Most candidates did not label that the angle of incidence ($\angle$ i) is equal to the angle of emergence ($\angle$ e) on the ray diagram or did not express the same in words. Some candidates drew the diagram taking a polychromatic ray. Many candidates did not mark the arrows on the diagram.

(b) Most candidates calculated the wavelengths corresponding to the given extreme frequencies of the audible range correctly.

(c) While a number of candidates were able to attempt the question correctly, some made mistakes in converting the distance from km to m. Some candidates applied a wrong formula.

(d) Many candidates could answer this question correctly but some candidates could not write the correct relation.

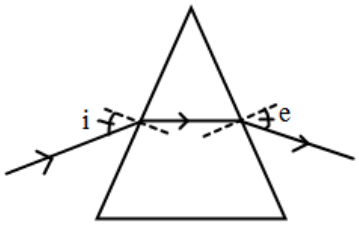
(e) This question was answered correctly by most of the candidates. Some candidates could not differentiate between *resistance* and *specific resistance*.

Suggestions for teachers

- More practice of drawing diagrams needs to be given to students, with all details included.
- Explain to the students the meaning of specific resistance and its SI unit.

MARKING SCHEME

Question 4

(a)	$\angle i = \angle e.$ 
(b)	(i) λ_1 = v/f_1 = 330/20 = 16.5 m $(ii)\lambda_2$ = v/f_2 = 330/20000 = 1.65 x 10^{-2} m
(c)	$v = \frac{2d}{t} \Longrightarrow t = \frac{2d}{v} = \frac{2 \times 300 \times 1000}{3 \times 10^8}$ $= 2 \times 10^{-3} second$ or 0.002 second
(d)	$f \propto \frac{1}{l}$, f: frequency, l: length of the string. $f \propto \sqrt{T}$ T: tension in the string.
(e)	It is the resistance of the conductor of unit length and unit cross-sectional area. SI unit of specific resistance is Ω m

Question 4

(a) An electric bulb of resistance 500Ω, draws a current of 0.4A. Calculate the power of the bulb and the potential difference at its end. [2]

(b) State two causes of energy loss in a transformer. [2]

(c) State two characteristics of a good thermion emitter. [2]

(d) State two factors upon which the rate of emission of thermions depends. [2]

(e) When does the nucleus of an atom tend to be radioactive? [2]

Comments of Examiners

(a) Many candidates attempted this question correctly but quite a number of candidates wrote incorrect formulae/ did wrong substitution and gave incorrect units.

(b) Most candidates stated the two causes of energy loss in a transformer correctly.

(c) Most of the candidates wrote the two characteristics of a good thermion emitter correctly.

(d) Most of the candidates wrote the two factors upon which the rate of emission of thermions depends correctly. Some candidates wrote *melting point* instead of *temperature*; others wrote *area* instead of *surface*.

(e) Most of the candidates answered correctly but some candidates wrote *neutron electron ratio* instead of *neutron proton ratio.* Common errors made by candidates were as follows:

- Instead of n:p, p:n was mentioned greater than 82 and in some cases, instead of neutron, electron was written.
- Some got confused between *atomic number* and *atomic mass.*
- Some gave the definition of radioactivity rather than the condition.
- A few candidates could not give two points.

Suggestions for teachers

- Give ample practice on numericals and formulae.
- Familiarize students with the probable errors that may be made while answering questions which are similar.
- Instruct students to read the questions carefully and write the points as per the requirement of the question.

MARKING SCHEME **Question 4**	
(a)	$P = i^2R = \frac{4}{10} \times \frac{4}{10} \times 500 = 80\ W$ $V = iR = \frac{4}{10} \times 500 = 200\ V$
(b)	In transformer energy is lost due to: – Hysteresis – Formation of Eddy Currents – Resistance of primary or secondary coil, *(any two)*
(c)	A good thermionic emitter should have: – Low work function – High melting point
(d)	Rate of emission of thermions depends on: – the nature of surface (work function), – temperature of the surface – surface area. *(any two)*
(e)	Nucleus of an atom tends to be radioactive when the atomic number is greater than 82 and imbalance of proton and neutron as compared to a normal stable atom.

SECTION I (40 Marks)

*Attempt any **four** questions from this Section*

Question 5

(a) A uniform half metre rule balances horizontally on a knife edge at 29 cm mark when a weight of 20 gf is suspended from one end. [3]

(i) Draw a diagram of the arrangement.

(ii) What is the weight of the half metre rule?

(b) (i) A boy uses a single fixed pulley to lift a load of 50 Kgf to some height. Another boy uses a single movable pulley to lift the same load to the same height. Compare the effort applied by them. Give a reason to support your answer. [3]

(ii) How does uniform circular motion differ from uniform linear motion?

(iii) Name the process used for producing electricity using nuclear energy.

(c) A pulley system with VR = 4 is used to lift a load of 175 kgf through a vertical height of 15 m. The effort required is 50 kgf in the downward direction. [4]

($g = 10\ N\ kg^{-1}$)

Calculate:

(i) Distance moved by the effort.

(ii) Work done by the effort.

(iii) M.A. of the pulley system.

(iv) Efficiency of the pulley system.

Comments of Examiners

(a)(i) Some candidates were able to solve this numerical correctly. Common errors made by candidates were as follows:

- Drew 100 cm scale instead of 50 cm.
- Did not understand what the *knife edge* is?
- 20 gf weight was suspended at the wrong end.
- Key labelling such as C.G, weight of the scale was missing.

(ii) Due to confusion in the diagram, many candidates substituted wrong values of the torque arm and expressed the answer with incorrect unit i.e. only 'g' in place of 'gf'.

(b)(i) Many candidates could identify that the movable pulley will require less effort but could not explain it with the M.A. ratio of both pulleys.

(ii) Most of the candidates answered this correctly but some wrote *uniform circular motion is unaccelerated*.

(iii) Many candidates answered correctly but some wrote both nuclear fission and fusion. A few candidates gave the answer as "thermionic emission".

(c) Some candidates made conceptual errors by using $L \times L.A. = E \times E.A.$ to calculate the distance moved by the effort. Due to calculation errors in the first part, many candidates got wrong answers in the latter parts. Most candidates answered the third part correctly. In sub-part (iv) some could not express the answer in percentage.

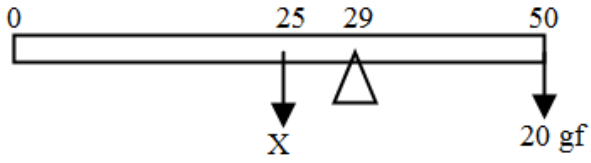
Suggestions for teachers

- The concept of centre of gravity should be made clear to students and clarify to them that the fulcrum may or may not lie at this point.
- Encourage drawing sketches while solving numericals.
- More practice of the numericals needs to be given to students.
- Students should be made aware that due to unavailability of effective control mechanism during nuclear fusion, only nuclear fission is used for the production of electricity.
- Acquaint students with the difference between d_E and E.A. and d_L and L.A. Also, sufficient practice in numericals is required.

MARKING SCHEME

Question 5

(a) (i)



(ii) X × 4 = 21 x 20

X = 105 g f weight of half metre rule = 0.105 kg f

(b) (i) Effort applied will be in the ratio 2:1 as M.A. of single fixed pulley is 1 whereas M.A. of single movable pulley is 2.

(ii) Uniform circular motion is an accelerated motion and Uniform linear motion is an unaccelerated motion.

(iii) Controlled chain reaction of nuclear fission of a radioactive substance.

(c) (i)Velocity ratio = d_E/d_L or 4= $d_E/15 \Rightarrow d_E$ = 60 m

$(ii)\ W = 50 \times 10 \times 60 = 30000$ J

$(iii)\ MA = \frac{175\times10}{50\times10} = 3.5$

$(iv)\ \eta = \frac{MA}{VR} \times 100 = \frac{3.5}{4} \times 100 = 87.5\%$

Question 6

(a) (i) How is the transference of heat energy by radiation prevented in a calorimeter? [3]

(ii) You have a choice of three metals A, B and C, of specific heat capacities 900 $Jkg^{-1}{}^{o}C^{-1}$, 380 $Jkg^{-1}{}^{o}C^{-1}$ and 460 $Jkg^{-1}{}^{o}C^{-1}$ respectively, to make a calorimeter. Which material will you select? Justify your answer.

(b) Calculate the mass of ice needed to cool 150g of water contained in a calorimeter of mass 50g at 32ºC such that the final temperature is 5ºC. [3]

Specific heat capacity of calorimeter = 0.4 J/gºC

Specific heat capacity of water = 4.2 J/gºC

Latent heat capacity of ice = 330 J/g

(c) (i) Name the radiations which are absorbed by greenhouse gases in the earth's atmosphere. [4]

(ii) A radiation X is focused by a particular device on the bulb of a thermometer and mercury in the thermometer shows a rapid increase. Name the radiation X.

(iii) Name two factors on which the heat energy liberated by a body depends.

Comments of Examiners

(a) (i) Most of the candidates wrote about prevention of conduction instead of prevention of transference of heat energy by radiation.

(ii) Majority of the candidates answered this part correctly. Some candidates chose the material correctly but were incorrect in justifying the answer.

(b) Lack of clarity of the concept was observed. For ice, most of the candidates used the formula mL only and used the value of latent heat capacity of ice (336 J/g) instead of the given value 330 J/g. Some candidates did not involve calorimeter in the heat exchange. Calculation errors were also observed.

(c) (i) Many candidates gave the answer as *UV radiations* or *long wavelength radiations.*

(ii) Most candidates answered correctly except for a few who got confused as to how two consecutive answers could be the same.

(iii) Most candidates named one factor on which the heat energy liberated by a body depends correctly. Some candidates failed to write *fall in temperature* and mentioned only *temperature*.

Suggestions for teachers

- Discussion needs to be done on calorimeter and ways of minimising heat losses.
- Explain to students the differentiation between bad conductors and good conductors with reference to the specific heat capacity.
- More practice should be given to students in solving a variety of questions based on calorimetry. Also, ask them to use only the values given in the question.
- Give adequate practice in writing the answers of conceptual questions.

MARKING SCHEME

Question 6

(a)	(i) Both (inner and outer) surfaces of calorimeter are highly polished. (ii) Metal B is the best option to make a calorimeter. B has the lowest specific heat capacity; hence it will absorb the least amount of heat.
(b)	Heat gained by ice = $mL + mc\Delta T = m(330 + 4.2 \times 5) = 351m$ J Heat given out by water and calorimeter= $(150 \times 4.2 + 50 \times 0.4) \times (32 - 5)$ $= 17550$ J Mass of ice = $\frac{17550}{351}$ = 50 g
(c)	(i) Infra-red radiations of long wavelength (ii) Infra-red radiations / heat radiations (iii) mass of the body Specific heat capacity of the body Change in temperature of the body *(Any two correct factors)*

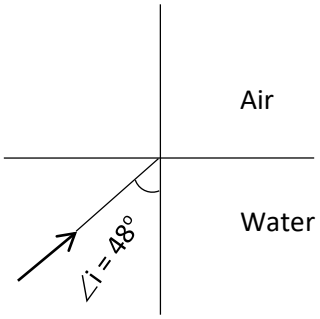
Question 7

(a) A Lens forms an upright and diminished image of an object when the object is placed at the focal point of the given lens. [3]

(i) Name the lens.

(ii) Draw a ray diagram to show the image formation.

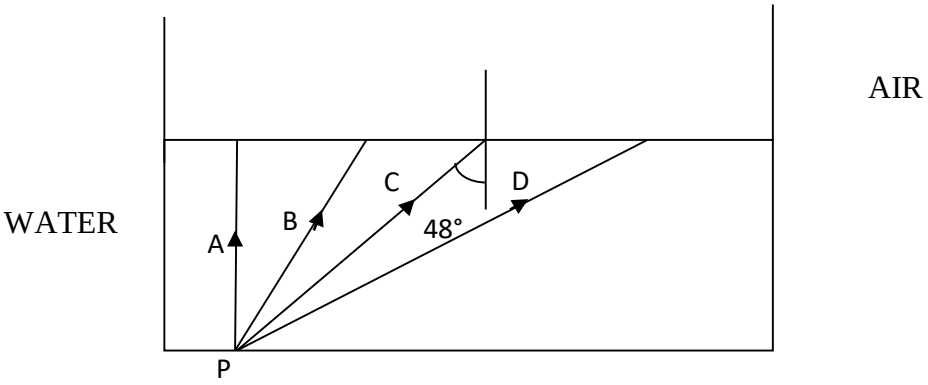
(b) A ray of light travels from water to air as shown in the diagram given below: [3]



(i) Copy the diagram and complete the path of the ray. Given the critical angle for water is 48°.

(ii) State the condition so that total internal reflection occurs in the above diagram.

(c) The diagram below shows a point source P inside a water container. Four rays A, B, C, D starting from the source P are shown upto the water surface. [4]



(i) Show in the diagram the path of these rays after striking the water surface. The Critical Angle for water air surface is 48°.

(ii) Name the phenomenon which the rays B and D exhibit.

Comments of Examiner

(a) (i) Most of the candidates named the lens correctly but some of them wrote *convex* instead of *concave.*

(ii) Most of the candidates drew the diagram properly but some candidates made the following errors:
- the object was not drawn at the focus.
- the image drawn was not dotted.
- the arrows were missing before and after refraction.
- the lens was labelled wrongly.

Suggestions for teachers
- Give substantial practice of drawing ray diagrams and to lay stress on
- Drawing arrows on the rays before and after the refraction.
- Drawing dotted line for virtual image.
- Explain the critical angle and TIR clearly with lots of examples.

(b) (i) Most of the candidates drew the diagram correctly. Some completed the diagram assuming $\angle C = 42$ so they showed total internal reflection. Others drew the ray along the normal. Several candidates did not mark the angle of refraction.

(ii) Many candidates wrote the conditions of total internal reflection correctly. Some were not clear about the concept of critical angle and conditions of total internal reflection.

(c) (i) Very few candidates got the path of all four rays correct.

MARKING SCHEME

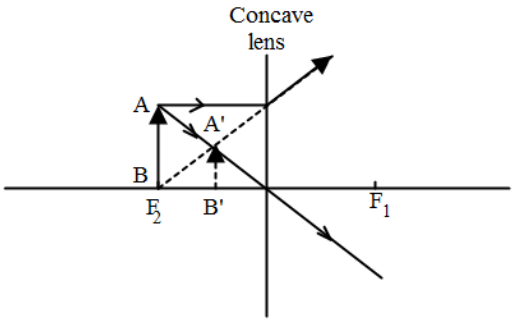
Question 7

(a) (i) Concave lens

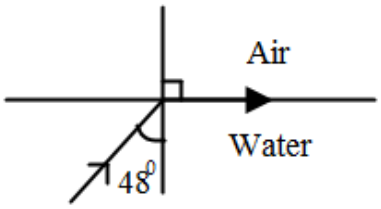
(ii) A ray shown parallel to the principal axis and appears to be coming from F_2.

A ray shown passing through optical centre and moving un-deviated.

Image shown correctly with object at the focus.

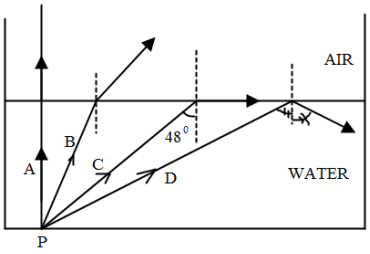


(b) (i)



(ii) $\angle i$ should be greater than 48°.

(c) (i)



(ii) Ray B undergoes refraction of light

Ray D undergoes total internal reflection of light.

Question 8

(a) Name the factor that determines: [3]

(i) Loudness of the sound heard.

(ii) Quality of the note.

(iii) Pitch of the note.

(b) (i) What are damped vibrations? [3]

(ii) Give one example of damped vibrations.

(iii) Name the phenomenon that causes a loud sound when the stem of a vibrating tuning fork is kept pressed on the surface of a table.

(c) (i) A wire of length 80 cm has a frequency of 256 Hz. Calculate the length of a similar wire under similar tension, which will have frequency 1024 Hz. [4]

(ii) A certain sound has a frequency of 256 hertz and a wavelength of 1.3 m.

1. Calculate the speed with which this sound travels.

2. What difference would be felt by a listener between the above sound and another sound travelling at the same speed, but of wavelength 2.6 m?

Comments of Examiners

(a) (i) This part was answered by most of the candidates except for some who wrote *frequency* or *pitch*.

(ii) This part was correctly attempted by most of the candidates except for some who wrote 'timbre' or 'wavelength'. Some had also used the terms as *wave note* or *wave pattern*.

(iii) Most candidates attempted this part correctly except for those who wrote 'wavelength', 'shrillness', 'flatness'.

(b) (i) Most of the candidates did not write the term 'decreasing amplitude'.

(ii) Many candidates did not make it clear whether the vibrations were in vacuum or medium. Some wrote only the name of the instrument.

(iii) Most of the candidates answered this correctly as 'forced vibrations' or 'resonance' but a few candidates wrote the phenomenon as 'echo'.

Suggestions for teachers

- Explain with lots of examples the relation between the characteristics of sound which are subjective in nature and the corresponding measurable quantities on which they depend and which are objective in nature. Also, the difference between wavelength and waveform should be made clear to students. Explain free, forced and damped vibrations clearly.
- It is advisable to do at least basic numerical using $v = f\lambda$. The qualitative understanding and interpretation depends on that and application becomes much clearer.

(c) (i) Most candidates scored well in this question.

(ii) 1. This part was attempted well by most of the candidates.

2. Some candidates showed the working of the problem but failed to write the difference felt by the listener.Also, some used the terms *shrillness* and *loudness* interchangeably, without actually knowing the difference.

MARKING SCHEME

Question 8

(a)	(i) Intensity/ amplitude of the sound wave (ii) wave form/ number of overtones present in the waves (iii)Frequency of the wave *(Any other correct factor)*
(b)	(i) The periodic vibrations of decreasing amplitude due to the presence of a resistive force are called as damped vibrations. (ii) – A vibrating tuning fork in air – Oscillations of a simple pendulum in air – A slim branch of a tree pulled and released *(Any one)* (iii) Forced vibration or resonance
(c)	(i) $\frac{f_1}{f_2} = \frac{l_2}{l_1}$ $\frac{256}{1024} = \frac{l_2}{80}$ $l_2 = \frac{80 \times 256}{1024}$ $l_2 = 20\ cm$ (ii) $V = 256 \times 1.3 = 332.8\ ms^{-1}$ $f = \frac{V}{\lambda} = \frac{332.8}{2.6} = 128\ Hz$ As f in 2nd case is less, $\therefore$ sound is shriller in 1st case.

Question 9

(a) (i) Name the colour code of the wire which is connected to the metallic body of an appliance. [3]

(ii) Draw the diagram of a dual control switch when the appliance is switched 'ON'.

(b) (i) Which particles are responsible for current in conductors? [3]

(ii) To which wire of a cable in a power circuit should the metal case of a geyser be connected?

(iii) To which wire should the fuse be connected?

(c) (i) Explain the meaning of the statement 'current rating of a fuse is 5A'. [4]

(ii) In the transmission of power, the voltage of power generated at the generating stations is stepped up from 11kV to 132kV before it is transmitted. Why?

Comments of Examiners

(a) (i) Most of the candidates attempted this part correctly but in some cases, following errors were observed:
- Candidates wrote the colour code for all the three wires which implies that they did not know which wire is connected to the metallic body of the appliance.
- Some did not write the colour code but identified the wire as earth wire.
- Some wrote incorrect colour.

(ii) Most candidates did not draw the diagram correctly. Vague diagrams were drawn by a few candidates, such as physical appearance of a switch. In some cases, load was connected directly to the live wire. Proper labelling was not done by many candidates.

(b) (i) While many candidates answered correctly, some wrote protons/ neutrons or positive and negative charges.

(ii) A few candidates gave the answer as 'neutral' or 'live' wire.

(iii) Most candidates attempted this part correctly.

(c) (i) Most of the candidates wrote about the maximum limit of current through the wire but failed to write about the melting of wire in case the current exceeds.

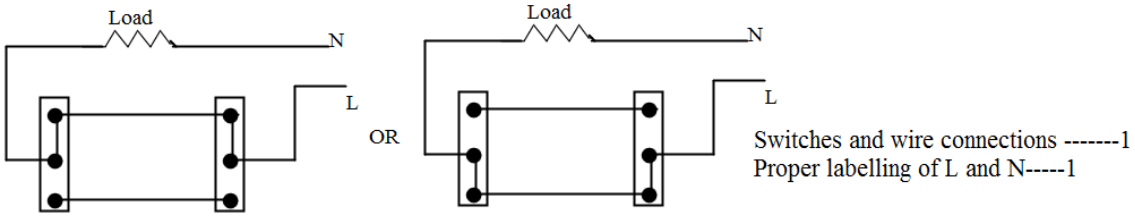
(ii) Many candidates wrote about minimising the power losses but failed to write about the decrease of current due to increased voltage. Some did not understand the question and wrote vague answers.

Suggestions for teacher

- Train the students to read the question carefully, ascertain the requirement and answer it.
- Explain the working of dual control switches with a diagram and emphasise that the students practice drawing diagrams.
- Explain the concept of earthing clearly to the students with the concept of potential.
- Explain the relation $P = VI$ in relation to the power transmission.

MARKING SCHEME

Question 9

(a)	(i) Green / Yellow (ii)  Switches and wire connections -------1 Proper labelling of L and N-----1
(b)	(i) Electrons (ii) Earth wire (iii) Live wire
(c)	(i) It can afford a maximum current of 5A. If current in the circuit exceeds beyond 5A, fuse blows. (ii) For given electric power, the current becomes low at a high voltage and therefore the loss of energy due to heating in the line wire becomes less.

Question 10

(a) Answer the following questions based on a hot cathode ray tube. [3]

(i) Name the charged particles.

(ii) State the approximate voltage used to heat the filament.

(iii) What will happen to the beam when it passes through the electric field?

(b) State three factors on which the rate of emission of electrons from a metal surface depends. [3]

(c) (i) What are free electrons? [4]

(ii) Why do they not leave the metal surface on their own?

(iii) How can they be made to leave the metal surface? (State any two ways)

Comments of Examiners

(a) (i) Most of the candidates attempted this part correctly but some confused thermionic emission with radioactive phenomenon and gave the answer as α, β and γ.

(ii) Most of the candidates were confused with household voltage and hence wrote 220V or vague values such as 1000V.

(iii) Most candidates wrote partial answers to this part, such as:

- deflects towards screen.
- deflects and forms parabolic path, but direction was missing.
- deflects towards positive terminal.

Suggestions for teacher

- Concept of free electrons needs to be explained to the students and different ways of emission of electrons also needs to be discussed.
- Explain working of cathode ray tube thoroughly to the students.

(b) Most of the candidates wrote answered correctly. Some candidates wrote *melting point* instead of *temperature*. Many candidates wrote *area* and missed out the word *surface*.

(c) (i) Most of the candidates had a vague idea of free electrons. They wrote that all valence electrons are free electrons.

(ii) Some candidates wrote that free electrons do not possess any energy. In some answers, the word *sufficient* was missing. Lack of clear idea of why they can't leave the metal surface was observed.

(iii) One way, i.e. of heating was given correctly by most candidates. Some wrote 'burning' instead of heating. A few wrote 'nuclear energy'.

MARKING SCHEME

Question 10

(a)	(i)	Cathode rays / high speed electrons
	(ii)	6 V
	(iii)	The beam will get deflected towards the positive plate
(b)	(i)	Temperature of the metal surface
	(ii)	Surface area of the metal.
	(iii)	Nature of metal surface.
(c)	(i)	Electrons in outer orbits are attracted weakly by the nucleus and so they are loosely bound and are called free electrons.
	(ii)	They do not have sufficient kinetic energy.
	(iii)	By imparting heat energy or light energy or electrical energy to the metal surface.

Note: For questions having more than one correct answer/solution, alternate correct answers/solutions, apart from those given in the marking scheme, have also been accepted.

GENERAL COMMENTS

Topics found difficult/ confusing by candidates

- Conversion of units.
- Numerical on moment of force.
- Advantages of movable and fixed pulley.
- Problems on calorimetry.
- Ray diagrams for lenses and prism.
- Reason for stepping up voltage during power transmission.
- Dual control switch.
- Numerical based on sound
- Specific resistance and its unit.
- Causes of energy losses in the transformer.

Suggestions for candidates

- Focus more on conceptual learning rather than rote learning.
- Make observations and try to relate your learning with it.
- Always participate in class discussion.
- Learn to write answers precisely and to the point.
- Avoid selective study. All topics are covered in Section I which is compulsory.
- Avoid changing the order of sequence of questions and numbering system while attempting the paper.
- Write in a neat and a legible handwriting.
- Learn the principles, laws and definitions accurately.
- While writing the answers it is not only important to cover all the points but also to present them in a proper sequence.
- It is advisable to state the meaning of the symbols if the answer is given in terms of any formula. Do not use any abbreviations which are not standard.
- The answers need to be given in SI units unless it is asked otherwise.
- It is advisable to solve at least last five years question papers.
- It is advisable to learn tables and squares up to 30. This will save a lot of time spent on calculation.
- It is advisable to present the final answer in the decimal form. Answer in fraction is treated as incomplete calculation.
- Units should be written without spelling errors.