I TERM EXAMINATION : 2025-26

CLASS - XII (CBSE)

PHYSICS

[THEORY] [042]

Maximum Marks : 70

Time allowed : Three hours

General Instructions : -

(i) This question paper contains 33 questions. All questions are compulsory.

(ii) This question paper is divided into FIVE sections. Section A, B, C, D and E.

(iii) In Section 'A' question number 1 to 16 are multiple choice type questions. Each question carries 1 mark.

(iv) In Section 'B' question number 17 to 21 are very short answer type questions. Each question carries 2 marks.

(v) In Section 'C' question numbers 22 to 28 are short answer type questions. Each question carries 3 marks.

(vi) In Section 'D' question number 29 and 30 are case study based questions. Each question carries 4 marks.

(vii) In Section 'E' question numbers 31 to 33 are long answer type questions. Each question carries 5 marks.

(viii) There is no overall choice given in the question paper. However, an internal choice has been provided in a few questions in all the sections except section 'A'.

(ix) Use of calculators is not allowed.

You may use the following values of physical constants wherever necessary:

$c = 3 \times 10^8$ m/s , $h = 6.63 \times 10^{-34}$ Js , $e = 1.6 \times 10^{-19}$ coulomb

$\mu_0 = 4\pi \times 10^{-7}$ TmA^{-1}, $\varepsilon_0 = 8.854 \times 10^{-12}$ C^{2}N^{-1}m^{-2}, $\frac{1}{4\pi\epsilon_0} = 9.0 \times 10^9$ Nm^2 C^{-2}

$m_e = 9.1 \times 10^{-31}$ kg , $m_n = 1.675 \times 10^{-27}$ Kg , $m_p = 1.673 \times 10^{-27}$ kg,

$N_A = 6.023 \times 10^{23}$ per gm mole, $K_B = 1.38 \times 10^{-23}$ JK^{-1}

SECTION - A

Q.1. Two charges -q each are placed at the vertices A and B of an equilateral triangle ABC. If M is the mid-point of AB, the net electric field at C will point along.

(a) CA (b) CB (c) MC (d) CM

Q.2. A student has three resistors, each of resistance R. To obtain a resistance of $\frac{2}{3}$ R, the student should connect :

(a) All the three resistors in series.

(b) All the three resistors in parallel

(c) Two resistors in series and then this combination in parallel with the third resistor.

(d) Two resistors in parallel and then this combination in series with the third resistor.

Q.3. A 1 cm straight segment of a conductor carrying 1A current in x-direction lies symmetrically at origin of cartesian coordinate system. The magnetic field due to this segment at point (1 m, 1m , 0) is :

(a) $1.0 \times 10^{-9}\hat{K}T$ (b) $-1.0 \times 10^{-9}\hat{K}T$

(c) $\frac{5.0}{\sqrt{2}} \times 10^{-10}\ \hat{K}\ T$ (d) $-\frac{5.0}{\sqrt{2}} \times 10^{-10}\hat{K}T$

Q.4. If speed of a charged body is increasing continuously, then changes in its charge and specific charge will be :

(a) Charge increases but specific charge decreases.

(b) Charge remains unaffected but specific charge decreases

(c) Both charge and specific charge decrease.

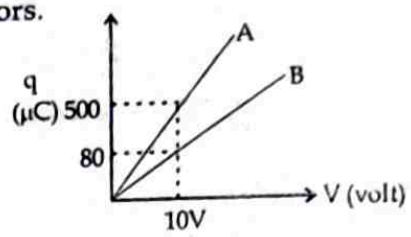
(d) Charge remains constant but specific charge increases.

Q.5. Across a metallic conductor of non-uniform cross-section, a constant potential difference is applied. The quantity which remains constant along the conductor is :

(a) Current (b) Drift velocity

(c) Electric field (d) Current density

Q.6. Figure shows charge (q) versus voltage (V) graph for series and parallel combination of two capacitors. The capacitances of capacitors are :



(a) 50 μF and 30 μF

(b) 40 μF and 10 μF

(c) 20 μF and 30 μF

(d) 60 μF and 40 μF

Q. 7. Consider two identical dipoles D_1 and D_2. Charges -q and q of dipole D_1 are located at (0, 0) and (a, 0) and that of dipole D_2 at (0, a) and (0, 2a) in x - y plane respectively. The net dipole moment of the system is :

(a) $qa(\hat{i}+\hat{j})$ (b) $-qa(\hat{i}+\hat{j})$

(c) $qa(\hat{i}-\hat{j})$ (d) $-qa(\hat{i}-\hat{j})$

Q.8. The electric field in a region is given by $\vec{E}=(Ax+B)\hat{i}$ where E is in $^{N}/_{C}$ and x is in meters. The value of constants are A = 20 SI unit and B = 10 SI unit. If the potential at x = 1 is V_1 and that at x = –5 is V_2 then $V_1 - V_2$ will be :

(a) –180 V (b) –500 V (c) 180 V (d) 520 V

Q.9. A capacitor is charged by a battery. The battery is removed and another identical uncharged capacitor is connected in parallel. The total electrostatic energy of the resulting system :

(a) Increases by a factor of 4

(b) decreases by a factor of 2

(c) remains the same

(d) Increases by a factor of 2

Q.10. Beams of electrons and protons move parallel to each other in the same direction. They :

(a) attract each other

(b) repel each other

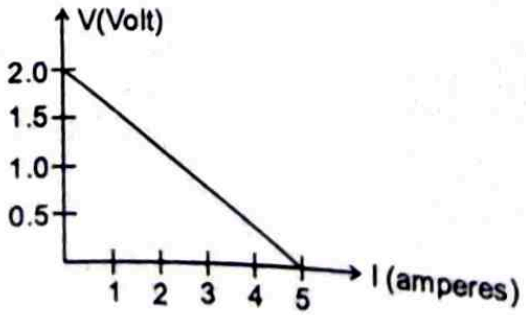
(c) neither attract nor repel

(d) experience force of attraction or repulsion depending upon speed of beams

Q.11. A charge of 1.6×10^{-10} C is moving with a velocity $\vec{v}=(4\hat{i}+3\hat{k})ms^{-1}$ in a magnetic field. $\vec{B}=(3\hat{k}+4\hat{i})T$. The force on this test charge is :

(a) $24\hat{j}N$ (b) $-24\hat{j}N$ (c) $24\hat{K}N$ (d) 0

Q.12. For a cell, the graph between the potential difference (V) across the terminals of the cell and current (I) drawn from the cell is shown in the figure given below :



The e.m.f. and the internal resistance of the cell are

(a) 2 V, 0.5 Ω (b) 2 V, 0.4 Ω

(c) 72 V, 0.5 Ω (d) 72 V, 0.4 Ω

For questions number 13 to 16 two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the options (a), (b), (c),and (d) as given below :

(a) If both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) If both Assertion (A) and Reason (R) are true but Reason is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false and Reason (R) is false.

Q.13. **Assertion (A) :** Work done in moving a charge around a closed path, in an electric field is always zero.

Reason (R) : Electrostatic force is a conservative force.

Q.14. **Assertion (A) :** The temperature coefficient of resistance is positive for metals and negative for semi-conductors.

Reason (R) : The charge carriers in metals are negatively charged whereas in semiconductors, they are positively charged.

Q.15. **Assertion (A) :** The electrostatic potential energy of the system increases if a proton is brought near another proton.

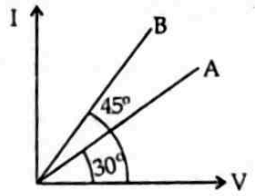
Reason (R) : Potential energy increases when work is done against electrostatic force.

Q.16. **Assertion (A) :** Ammeter is connected in series in an electrical circuit.

Reason (R) : The resistance of ammeter is very low as compared to the galvenometer.

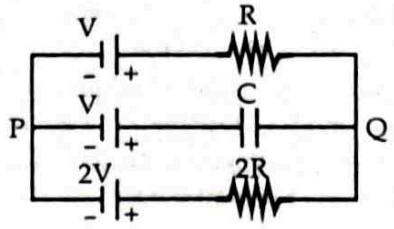
SECTION - B

Q.17. Two wires A and B of different metals have their lengths in ratio 1 : 2 and their radii in ratio 2 : 1 respectively. I-V graphs for these is shown in the figure. Find the ratio of their (i) Resistances (R_A/R_B) and (ii) Resistivities (ρ_A/ρ_B)



OR

In the circuit three ideal cells of e.m.f. V, V and 2V are connected to a resistor of resistance R, a capacitor of capacitance C and another resistor of resistance 2R as shown in figure. In the steady state find (i) the potential difference between P and Q and (ii) potential difference across capacitor C.

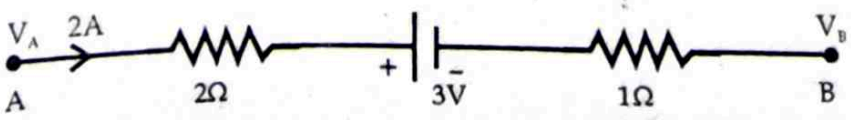


Q.18. Two fixed point charges +4e and +e units are separated by a distance 'a'. Where should the third point charge be placed for it to be in equilibrium ?

Q.19. Two wires of the same length are shaped into a square of side 'a' and a circle of radius 'r'. If they carry same current, then find the ratio of their magnetic moments.

Q.20. A heating element using nichrome connected to a 230 V supply draws an initial current of 3.2 A which settles after a few seconds to a steady value of 2.8 A. What is the steady temperature of the heating element if the room temperature is 27.0 °C and the temperature coefficient of resistance of nichrome is $1.70\times10^{-4}\ °C^{-1}$?

Q.21. Calculate the potential difference $V_A - V_B$ between the points A and B in the given figure.



SECTION - C

Q.22. In a region of a uniform electric field $\vec{E}$, a negatively charged particle in moving with a constant velocity $\vec{v} = -v_0 \hat{i}$ near a long straight conductor coinciding with XX′ axis and carrying current I towards –X axis. The particle remains at a distance d from the conductor. [3]

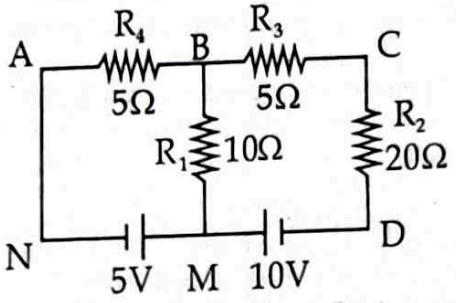
(i) Draw diagram showing direction of electric and magnetic fields.
(ii) What are the various forces acting on the charged particle?
(iii) Find the value of V_0 in terms of E, d and I.

Q.23. If N drops of same size each having the same charge, coalesce to form a bigger drop. How will the following vary with respect to small drop? [3]

(i) Total charge on the bigger drop
(ii) Potential on the bigger drop
(iii) Capacitance of bigger drop

Q.24. A thin spherical conducting shell of radius R has a charge q. A point charge Q is placed at the centre of the shell. Find (i) The charge density on the outer surface of the shell and (ii) the potential at a distance of (R/2) from the centre of the shell. [3]

Q.25. Find the currents flowing through the branches AB and BC in the network shown. [3]



Q.26. Define current density and relaxation time. Derive an expression for resistivity of a conductor in terms of number density of charge carries in the conductor and relaxation time. [3]

OR

Plot a graph showing the variation of current density (j) versus the electric field (E) for two conductors of different materials. What information from this plot regarding the properties of the conducting material, can be obtained which can be used to select suitable materials for use in making : [3]

(i) standard resistance
(ii) connecting wires in electrical circuit.

Q.27. Rohan uses a portable electric lamp to light up his key board when working on her computer at night. The lamp consists of two small bulbs each of resistance 2Ω connected in series and is powered by a 20 V battery. [3]

(a) How much current is drawn by the portable lamp?
(b) Each of the two bulbs in the lamp is rated for continuous use of 10 hours only before they burn out. If the battery can supply a total energy of 4000 KJ, which of the two occurs first : the bulbs burn out or the battery drains out ? Show the working.

Q.28. How can a moving coil galvanometer be converted into an ammeter? To increase the current sensitivity of a moving coil galvanometer by 50% its resistance is increased so that the new resistance becomes twice its initial resistance by what factors does it voltage sensitivity change? [3]

SECTION - D

Question number 29 and 30 are case study based questions.

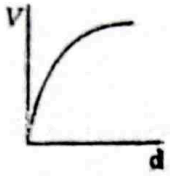
Q.29. **Read the following paragraphs and answer the questions that follow :** [4]

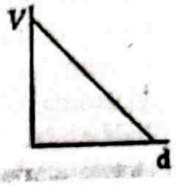
A parallel plate capacitor has two parallel plates which are separated by an insulating medium like air, mica, etc. When the plates are connected to the terminals of a battery, they get equal and opposite charges and an electric field is set up in between them. This electric field between the two plates depends upon the potential difference applied, the separation of the plates and nature of the medium between the plates.

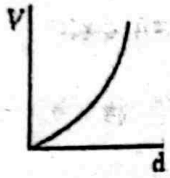
(i) The electric field between the plates of a parallel plate capacitor is E. Now the separation between the plates is doubled and simultaneously the applied potential difference between the plates is reduced to half of its initial value. The new value of the electric field between the plates will be :

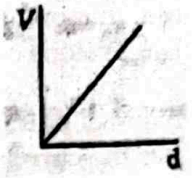
(a) E (b) 2E (c) $E/4$ (d) $E/2$

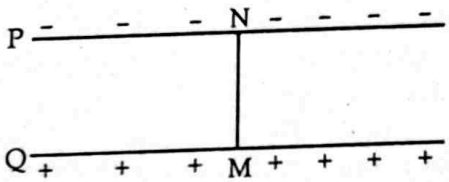
(ii) A constant electric field is to be maintained between the two plates of a capacitor whose separation d changes with time, which of the graph correctly depict the potential difference (V) to be applied between the plates as a function of separation between the plates (d) to maintain the constant electric field?

(a) 

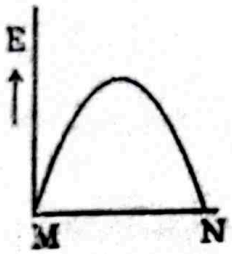
(b) 

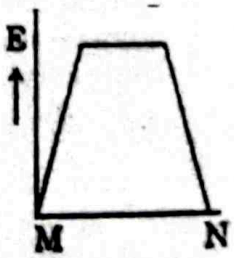
(c) 

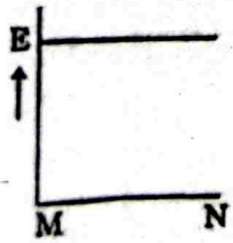
(d) 

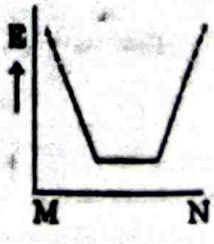
(iii) 

In the above figure P and Q are the two parallel plates of a capacitor. Plate Q is at positive potential with respect to plate P. MN is an imaginary line drawn perpendicular to the plates. Which of the graphs correctly shows the variations of the magnitude of electric field strength E along the line MN?

(a) 

(b) 

(c) 

(d) 

(iv) A sheet of metal of negligible thickness is placed between the plates P and Q and parallel to plates. The new capacitance will :

(a) remain same
(b) increase
(c) decrease
(d) none of these

OR

A material of dielectric constant K is filled completely in a parallel plate capacitor of capacitance C. The new value of its capacitance becomes :

(a) C (b) $\frac{C}{K}$ (c) CK (d) $C\left(1+\frac{1}{K}\right)$ [4]

Q.30. **Read the following passage carefully and answer the questions.**

Ohm's law is obeyed by many substances but one can't say that it's a fundamental law of nature. It's a basic law regarding flow of the current which defines resistance as constant of proportionality. The dependence of R was also discussed by Ohm's law. The potential applied across a conductor and current through it was also one of the important point discussed in this law.

(i) What will be resistance across a slabs if area is doubled?
- (a) Resistance will be doubled
- (b) Resistance will be halved
- (c) No change
- (d) Resistance will become 4 times

(ii) On what factors does the resistance depend ?
- (a) Material only
- (b) Dimensions of conductor only
- (c) Material and dimension both
- (d) None of these

(iii) How does the current density vary if area is doubled?
- (a) Becomes half
- (b) Becomes double
- (c) Does not vary
- (d) Becomes 4 times

OR

How does resistivity of a conductor change with increase in temperature?
- (a) Increases linearly
- (b) Decreases linearly
- (c) First increases and then decreases
- (d) Increases very rapidly

(iv) Which of these obeys Ohm's law?
- (a) Copper (b) Germenium
- (c) Electrolytes (d) Torch Bulb

SECTION - E

Q.31. (i) A small conducting sphere A of radius r, charged to a potential V, is enclosed in a spherical conducting shell B of radius R. If A and B are connected by a thin wire, calculate the final potential on sphere A and shell B. [3]

(ii) Write two characteristics of equipotential surface A uniform electric field of 50 NC^{-1} is set up in a region along +x axis. If the potential at the origin (0, 0) is 220 V, find the potential at a point (4m, 3m). [2]

OR

(i) What is difference between an open surface and a close surface? [1]

(ii) Define electric flux through a surface . A charge outside a Gaussiun surface does not contribute to total electric flux through the surface, why? [2]

(iii) A small spherical shell S_1 has point charges $q_1 = 3\mu C$, $q_2 = -2\mu C$ and $q_3 = 9\mu C$ inside it. This shell is enclosed in another big spherical shell S_2. A point charge Q is placed in between the two surfaces S_1 an S_2. If the electric flux through the surface S_2 is four times the flux through S_1, find charge Q. [2]

Q.32 (i) What is the source of force acting on a current carrying conductor placed in a magnetic field? Obtain the expression for force acting between two long straight parallel conductors carrying steady currents and hence define '1 ampere'. [3]

(ii) A point charge q is moving with velocity $\vec{v}$ in a uniform magnetic field $\vec{B}$. Find the work done by the magnetic force on the charge. [1]

(iii) Explain the necessary condition in which the trajectory of a charged particle is helical in a uniform magnetic field. [1]

OR

Write using Biot-Savart law, the expression for the magnetic field due to a element $\overrightarrow{d\ell}$ carrying current i at a distance $\vec{r}$ from it in vector form. Hence derive the expression for the magnetic field due to a current carrying circular loop of radius R at a point P distant x from its centre along the axis of the loop. [5]

Q.33. (i) A dielectric slab of dielectric constant 'k' and thickness 't' is inserted between plates of a parallel plate capacitor of plate separation d and plate area A. Obtain an expression for its capacitance (t < d). [3]

(ii) Two capacitors of different capacitances are connected first (i) in series and then (ii) in parallel across a d.c. source of 100 V. If the total energy stored in the combination in the two cases are 40 mJ and 250 mJ respectively, find the capacitances of the capacitors. [2]

OR

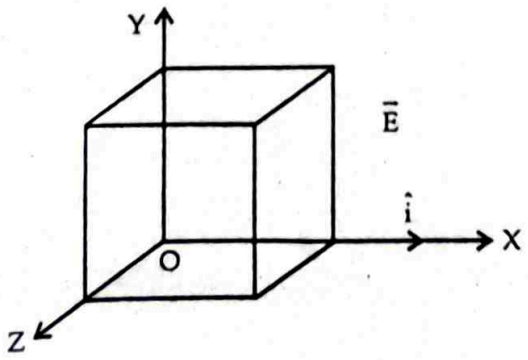
(i) Using Gauss' law show that the electric field $\vec{E}$ at a point near a uniformly charged infinite plane sheet, is given by $\vec{E} = \frac{\sigma}{2\epsilon_0}\ \hat{n}$, where symbols have their usual meanings. [3]

(ii) Electric field $\vec{E}$ in a region is given by $\vec{E} = (5x^2 + 2)\,\hat{i}$ where E is in N/C and x is in meters

A cube of side 10 cm is placed in the region as shown in figure. Calculate :

(a) the electric flux through the cube and.

(b) the net charge enclosed by the cube. [2]



#####

ii. How is the heart of a farmer diferent from that of a city person?

iii. Complete the sentence appropriately:
Rain is like a Calendar to the farmers because _____ .

iv. Complete the sentence appropriately:
The month of rain become a distant memory until it starts all over again, signifying the cyclic nature of _____.

v. Explain the significance of the different types of rain mentioned in the passage and how they contribute to the agricultural activities in the Naga Hills region.

vi. According to the above passage, why people who live in cities don't like rain?

vii. Pick up the option in which the word 'furrow' has not been used in the same way as in the passage.

a. When he frowns, a deep furrow forms in his brow.
b. A ploughed field is divided into sections of equal width separated by furrows.
c. Rapidly reaping the furrows he fled across the field.
d. The incessant rain filled all the furrows in the field with water.

Q.2 **Read the following passage carefully and answer the questions that follow.**

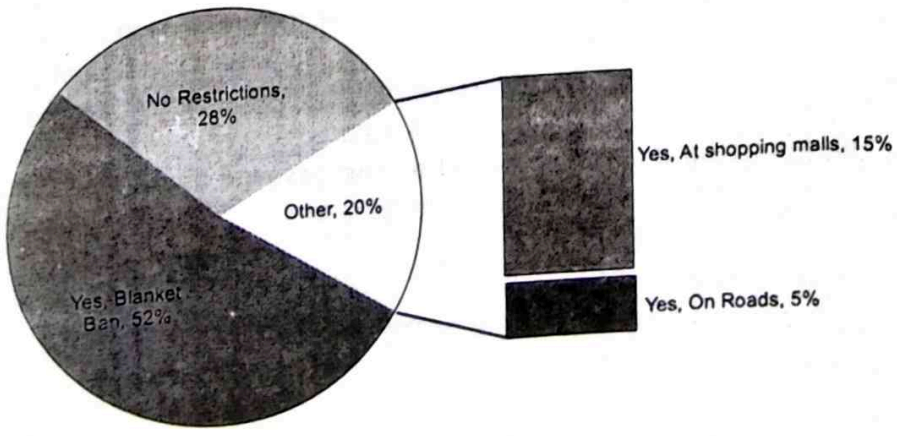
Most of us know that smoking causes cancer, lung disease, heart disease, can shorten life by 10 years or more and can cost a smoker thousands of rupees a year. So, why are people still smoking? The answer, in a word, is addiction.

Smoking is a hard habit to break because tobacco contains the very addictive chemical nicotine. The body and mind quickly get used to the nicotine in cigarettes. Soon, a person needs to have it just to feel normal.

People start smoking for different reasons. Some think it looks cool. Others start because their family members or friends smoke. Almost all adult tobacco users started before they were 18 years old. Most never expect to become addicts.

Many of the chemical in cigarettes, like nicotine and cyanide, are poisons that can kill in high doses. The body is smart. It goes on the defence when it's being poisoned. First time smokers often feel pain or burning in their throat and lungs, and some even cough vigorously the first few times they try tobacco. Over time, smoking leads to health problems such as heart disease, stroke, lung damage and many types of cancer- including lung, throat, stomach, and bladder cancer.

A survey was conducted to collect views of the people whether smoking should be allowed or not in public place. The results of the responses received have been depicted in the form of pie chart here.



[2]

ii. The book was found _____.

iii. Which word does 'awfully' not correspond to?

a. Immensely b. Terribly

c. Magnificent d. Dreadfully

OR

(B) And she was dragged down to where father was pacing to and fro, hands behind his back. 'Well'? He said sharply. Mother explained. He stopped and stared at the child. "Did you do that?"

'N- No.' she whispered?

i. Which statement is true about the incidence discussed in the above passage?

a. Kezia didn't tear the papers.

b. Grandmother encouraged her to tear the papers.

c. Father wanted to enquire about Kezia if she had torn the papers.

d. Kezia was never afraid of her father.

Q.7 **Answer Any two of the following questions in 40 - 50 words.** [6]

i. What did Bismillah Khan say after receiving the Bharat Ratna Award?

ii. What did Kezia's father do daily after coming back from office?

iii. Where did the two roads diverge in the poem 'The Road Not Taken'? What was the difficulty?

Q.8 **Answer Any one of the following questions in 40- 50 words:** [3]

i. Did the boy in 'The Lost Child' wait for the answer after pleading for sweets? Why?

ii. How did Toto behave with Nana, the pet donkey?

Q.9 **Answer Any One of the following question in 100-120 words:** [5]

i. How would you react to your school being replaced by a computer operating system and a mechanical teacher replacing your present teacher, keeping in mind the lesson 'The Fun They Had'.

ii. In the story 'The Little Girl', how was Kezia's father different from Mr. Mc Donald's? Write a brief character sketch on both and compare them.

Q.10 **Answer Any One of the following question in 100-120 words:** [5]

i. 'A child longs for toys, sweets and other things but not at the cost of his parents.' Comment.

ii. Do you think it is advisable to keep a monkey like Toto as part of pets in the house? Why / Why not?

****