

ST. MICHAEL'S SR. SEC. SCHOOL
3, PUSA ROAD, NEW DELHI
CLASS XII ASSIGNMENT MID-TERM
(2026-27)

VALUE EDUCATION

Chapters:

1. Building Your Character
2. Healthy Relationships
3. Overcoming Loneliness
4. Dealing with Discouragement
5. Stop Worrying

Answer the following questions:

1. What is character? Explain how our habits, choices, and actions contribute to building a strong character.
2. What are the essential qualities of a healthy relationship? Explain any three.
3. How can effective communication and mutual respect strengthen relationships?
4. What are some common causes of loneliness among young people? Suggest two healthy ways to overcome it.
5. Why is it important to accept and understand our emotions when we feel lonely or discouraged?
6. What is discouragement? How can a person turn failure or disappointment into an opportunity for growth?
7. Write **True or False**:
A person with a strong character always makes responsible choices, even when no one is watching. _____
8. What is the difference between **healthy concern** and **unnecessary worry**?
9. Suggest any three practical ways to manage worry and maintain a calm and positive outlook.
10. **Situation-based question:**
You have worked hard for an important examination but did not get the result you expected. You feel disappointed and worried about your future. What would you do to overcome discouragement and deal with your worries in a healthy way?

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CHEMISTRY

1. Zn, Cd & Hg are not treated as true transition elements. Why?
2. Cu & Ag are transition metals although they have completely filled d-orbitals. Why?
3. Why do some d-block elements have irregular (exceptional) electronic configuration?
4. Atomic size does not change appreciably in a row of transition metals. Why?
5. Transition elements have variable oxidation states. Why?
6. Transition metals have high melting and boiling points. Why?
7. Transition metals have high enthalpy of atomization. Why?
8. Transition metals show catalytic properties. Why?
9. Transition metals and their salts are generally colored. Why?
10. Why do transition metals form coordination compounds?
11. Why do transition metals form alloys?
12. Why do transition metals form interstitial compounds?
13. Zn, Cd & Hg have low boiling points and Hg is liquid. Why?
14. Transition metals and many of their compounds show paramagnetic behavior. Why?
15. Why is d^1 configuration very unstable in ions?
16. Why is Cr^{2+} strongly reducing while Mn^{3+} is strongly oxidizing?
17. Why is cobalt (II) stable in aqueous solution but gets oxidized in the presence of complexing agents?
18. Why are Mn^{2+} compounds more stable than Fe^{2+} compounds?
19. Why is Fe^{3+} more stable than Fe^{2+} ?
20. Why do transition metals exhibit their highest oxidation states in oxides and fluorides?
22. Why is the E° value for the $\text{Mn}^{3+}/\text{Mn}^{2+}$ couple much more positive than that for $\text{Cr}^{3+}/\text{Cr}^{2+}$ or $\text{Fe}^{3+}/\text{Fe}^{2+}$? Explain.
23. In the series Sc ($Z = 21$) to Zn ($Z = 30$), why is the enthalpy of atomization of zinc the lowest?
24. Why is Cu^+ ion not stable in aqueous solution?
25. Why is actinoid contraction greater from element to element than lanthanoid contraction?
26. Indicate the electrophilic and nucleophilic centers in acetaldehyde.
27. How will you convert:
 1. Isopropyl chloride to 2-methylpropionaldehyde.
 2. benzene to benzaldehyde
 3. benzoic acid to acetophenone
 4. propene to propanal
 5. butanoic acid to 2-hydroxybutanoic acid
 6. benzoic acid to m-nitrobenzyl alcohol
 7. propanol to propene
 8. propanol to butan-2-one.
 9. methyl magnesium bromide to ethanoic acid
 10. benzoic acid to benzyl chloride
 11. acetone to chloroform
 12. acetylene to acetic acid

13. formaldehyde to propanol

14. acetophenone to 2-phenylbutan-2-ol

28. Arrange the following in the increasing order of the property indicated

CH_3CHO , HCHO , CH_3COCH_3 , $\text{C}_6\text{H}_5\text{CHO}$

(reactivity towards HCN) propan-1-ol,

propanone, propanal (boiling point)

29. Give the reaction mechanism for following reactions:

30. Give one chemical test to distinguish between following pair of compounds: Write the chemical reaction involved.

1. propan-2-ol and propanone
2. ethyl acetate and methyl acetate
3. benzaldehyde and benzoic acid
4. benzaldehyde and acetaldehyde
5. formic acid and acetic acid
6. propanal and propan-1-ol
7. ethanoic acid and ethylethanoate
8. CH_3CHO and CH_3COCH_3
9. CH_3CHO and HCHO
10. acetophenone and benzophenone

31. Give reason for the following (i) cyclohexanone form cyanohydrin in good yield but 2, 2, 6 – trimethylcyclohexanone does not.

(ii) Benzaldehyde does not give Fehling's test.

(iii) The alpha H atoms in ethanal are acidic in nature.

(iv) p-nitrobenzaldehyde is more reactive than benzaldehyde towards nucleophilic addition reactions.

32. An organic compound (A) having molecular formula $\text{C}_5\text{H}_{10}\text{O}$ gives a positive 2, 4-DNP test. It does not reduce Tollens' reagent but forms an addition compound with sodium hydrogen sulphite. On reaction with I_2 in alkaline medium, it forms a yellow precipitate of compound B and another compound C having molecular formula $\text{C}_4\text{H}_7\text{O}_2\text{Na}$. On oxidation with KMnO_4 , [A] forms two acids D and E having molecular formula $\text{C}_3\text{H}_6\text{O}_2$ and $\text{C}_2\text{H}_4\text{O}_2$ respectively. Identity A, B, C, D and E.

33. Formaldehyde and acetaldehyde on treatment with dil. NaOH form A which on heating changes to B.

When B is treated with HCN , it forms C. Reduction of C with DIBAL- H yields D which on hydrolysis gives E. Identify A, B, C, D and E.

34. An aromatic compound X with molecular formula C_9H_{10} gives the following chemical tests:

- (i) Forms 2, 4-DNP derivative
- (ii) Reduces Tollens' reagent
- (iii) Undergoes Cannizzaro reaction
- (iv) On vigorous oxidation gives 1, 2-benzenedicarboxylic acid.

Identify X and write its IUPAC name. Also write the reactions involved in the formation of above mentioned products

35 State Kohlrausch's Law and write one application.

36. Explain why molar conductivity increases with dilution.
 37. Differentiate between electrolytic conductance and molar conductivity.
 38. Write the cell reaction for the Daniell cell and calculate E°_{cell} if:

- $\text{Zn}^{2+}/\text{Zn} = -0.76 \text{ V}$
- $\text{Cu}^{2+}/\text{Cu} = +0.34 \text{ V}$

39. What is the function of a salt bridge?
 40. Explain the working of a galvanic cell with a neat diagram.
 41. Why is conductivity measured using alternating current instead of direct current?
 42. Explain the variation of molar conductivity with concentration for:

- Strong electrolytes
- Weak electrolytes

43. The resistance of a conductivity cell containing 0.001 M KCl solution is 1500Ω . If the cell constant is 1.5 cm^{-1} , calculate the conductivity and molar conductivity.
 44. Calculate the standard EMF of the cell:



Given:

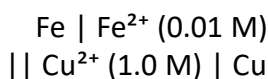
- $E^\circ(\text{Zn}^{2+}/\text{Zn}) = -0.76 \text{ V}$
- $E^\circ(\text{Cu}^{2+}/\text{Cu}) = +0.34 \text{ V}$

45. Calculate the equilibrium constant (K) for a cell whose standard EMF is 1.10 V at 298 K.
 46. Using Kohlrausch's law, calculate the limiting molar conductivity of CH_3COOH .

Given:

21. $\Lambda^\circ(\text{HCl}) = 426.2 \text{ S cm}^2 \text{ mol}^{-1}$
 22. $\Lambda^\circ(\text{CH}_3\text{COONa}) = 91.0 \text{ S cm}^2 \text{ mol}^{-1}$
 23. $\Lambda^\circ(\text{NaCl}) = 126.4 \text{ S cm}^2 \text{ mol}^{-1}$

47. Calculate the EMF of the following cell:



Given:

- a. $E^\circ(\text{Fe}^{2+}/\text{Fe}) = -0.44 \text{ V}$
 b. $E^\circ(\text{Cu}^{2+}/\text{Cu}) = +0.34 \text{ V}$

48. Calculate the standard Gibbs free energy change for a cell whose EMF is 0.46 V involving two electrons.
 49. The resistance of a conductivity cell filled with 0.02 M KCl solution is 250Ω . The conductivity of the solution is $0.00276 \text{ S cm}^{-1}$.

Calculate the cell constant

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BIOLOGY

1. A flowering plant is genetically self-compatible, but its pollen grains mature before the stigma becomes receptive. In another plant of the same species, the stigma becomes receptive first.

- (a) Identify the reproductive mechanisms involved in the two cases.
- (b) Explain how these mechanisms affect the probability of self-pollination and genetic variation.
- (c) If both plants grow in the same population, predict which condition is more likely to promote outbreeding and justify your answer.

2. A woman has a regular 28-day menstrual cycle. During one cycle, a sudden hormonal disturbance prevents the LH surge, but FSH secretion remains near normal.

- (a) Predict what will happen to ovulation.
- (b) What will happen to corpus luteum formation and progesterone secretion?
- (c) Predict the likely effect on the endometrium and explain whether implantation can occur normally.
- (d) Name the hormone whose normal mid-cycle surge was disrupted.

3. A couple has normal reproductive anatomy and regular menstrual cycles, yet pregnancy has not occurred despite repeated attempts. Assume that ovulation is occurring normally.

Design a logical sequence of investigations that could distinguish among:

- (i) failure of sperm production,
- (ii) blockage of sperm transport,
- (iii) failure of fertilisation,
- (iv) failure of implantation.

For each possibility, mention one appropriate reproductive technology or diagnostic approach that could help overcome or identify the problem.

4. In a family, a phenotypically normal couple has a child affected by an autosomal recessive disorder. The man's father was also affected by the same disorder, while the woman's parents were phenotypically normal.

- (a) Deduce the most likely genotypes of the couple.
- (b) Calculate the probability that their next child will be affected.
- (c) If the next child is unaffected, does this change the probability for a subsequent pregnancy? Explain using conditional probability rather than assuming that previous outcomes determine future ones.

5. A woman with blood group A marries a man with blood group B. They have two children: one with blood group O and another with blood group AB.

- (a) Deduce the genotypes of both parents.
- (b) Show how both apparently contrasting blood groups in the children can arise from the same parental combination.
- (c) Explain why the inheritance pattern of ABO blood groups cannot be described as a simple dominant–recessive pair of alleles.

6. A DNA molecule contains 20% adenine.

(a) Determine the percentage of cytosine, guanine and thymine.

(b) If the DNA is double-stranded, explain why the percentage of adenine must equal that of thymine even though the two strands may have very different base sequences.

(c) Suppose a mutation changes one base pair from A–T to G–C. Predict how the overall percentage of G + C changes if the DNA molecule contains 1000 base pairs.

7. A student says: “During DNA replication, each daughter DNA molecule contains one completely new strand and one completely old strand, so the old DNA is simply copied as a whole.”

(a) Identify the misconception.

(b) Explain the semiconservative nature of DNA replication.

(c) If a DNA molecule is allowed to replicate for three generations in a medium containing only normal nitrogen after initially being grown in ^{15}N , determine the proportion of DNA molecules containing at least one original ^{15}N -labelled strand after the third generation. Show the reasoning clearly.

8. A mutation occurs in the coding region of a gene, but the resulting protein has exactly the same amino acid sequence as the normal protein.

(a) Give a molecular explanation for how this is possible.

(b) Would you classify every such mutation as biologically irrelevant? Give a reasoned answer considering gene expression and evolutionary consequences.

(c) Distinguish this situation from a mutation that introduces a premature stop codon.

9. A population of insects contains two colour variants. Birds preferentially eat the more visible variant. Over several generations, the less visible variant becomes increasingly common.

(a) Explain this observation using natural selection rather than the idea that insects “developed” the useful colour because they needed it.

(b) Identify the three major steps linking variation to a change in allele frequency.

(c) Predict what would happen if the environment suddenly changed so that the previously advantageous colour became highly visible to predators.

10. Two isolated populations of the same species have been living under different environmental conditions for thousands of generations. They now show major differences in morphology, physiology and behaviour. However, individuals from the two populations can still mate and produce fertile offspring.

(a) Does the evidence necessarily prove that two new species have evolved? Explain.

(b) Which evolutionary mechanisms could have produced the observed differences despite the absence of reproductive isolation?

(c) If geographical contact is restored, what additional evidence would be most useful for deciding whether speciation has actually occurred?

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PHYSICS

Q1(a) An electric dipole is made of 2 charges $+q$ and $-q$ separated by distance $2a$. Derive expression for Electric field due to this dipole at a point distant r from center of dipole on its (i) Axial line in terms of its dipole moment p and (ii) Equatorial line in terms of its dipole moment p .

Q1(b) Derive expression for torque on electric dipole placed in a uniform electric field.

Q2(a) Using Gauss theorem, obtain an expression for electric field due to an infinitely long straight conductor of linear charge density λ .

Q2(b) Using Gauss theorem, prove that electric field inside a uniformly charged spherical shell is zero.

Q2(c) A point charge of $17.7 \mu\text{C}$ is located at the center of a cube of side 0.03 m . Find the electric flux through each face of the cube.

Q3(a) Derive expression for potential energy of 2 point charges q_1 and q_2 , separated by a distance r in an external electric field.

Q3(b) Four-point charges Q, q, Q and q are placed at the corners of square of side a . Find the potential energy of the system.

Q4(a) Derive expression for Capacitance of a parallel plate capacitor when a dielectric slab OR a conducting slab is inserted between its plates.

Q4(b) Two Capacitors of capacitances $3 \mu\text{F}$ and $6 \mu\text{F}$ are charged to potentials of 2 V and 5 V respectively. These two Capacitors are connected in series. Find the potential across each of the two Capacitors now.

Q5(a) Derive expression for Drift velocity of electron. Deduce its relation with electric current. Deduce Ohm's law from it.

Q5(b) Calculate the electric field in a Copper wire of cross-sectional area 2 mm^2 carrying a current of 1 A . The conductivity of copper is $6.25 \times 10^7 \text{ S/m}$.

Q6(a) Plot a graph showing variation of current I Vs resistance R connected to a cell of emf E and internal resistance r .

Q6(b) A battery of emf 3 V and internal resistance r gives a current of 0.5 A with an external resistance of 12Ω and a current of 0.25 A with external resistance of 25Ω . Calculate (i) internal resistance of the cell and (ii) emf of the cell.

Q7(a) Deduce balanced condition of wheatstone bridge using kirchoff's laws.

Q7(b) With a certain resistance in the left gap of a meter bridge, the balance point is obtained when a resistance of 10Ω is taken out from the resistance box. On increasing the resistance from the resistance box by 12.5Ω , the balance point shifts by 20 cm . Find the unknown resistance.

Q8(a) Kirchoff's 1st and 2nd laws are in accordance with laws of conservation of charge and energy respectively. Justify.

Q8(b) Two cells of emf's 3V and 4 V and internal resistances 1Ω and 2Ω respectively are connected in parallel so as to send current in the same direction through an external resistance of 5Ω . Draw the circuit diagram. Using Kirchoff's laws, calculate (i) current through each branch of the circuit and (ii) Potential difference across 5Ω resistance.

Q9 Using Biot Savart law, obtain expression for magnetic field due to a circular current carrying loop, at a point on the axis of the loop. State the rule used to find the direction of this magnetic field.

Q10 State Ampere Circuital law. Using Ampere-Circuital law, derive expression for magnetic field due to a straight infinite current carrying wire.

Q11 Derive expression for force per unit length between two infinitely long straight parallel current carrying wires. Hence define one Ampere.

Q12 Discuss motion of a charged particle in a uniform magnetic field with initial velocity (i) parallel to the field (ii) perpendicular to the magnetic field and (iii) at an arbitrary angle with the field direction.

Q13(a) Discuss Principle, construction and working of a Moving coil galvanometer.

Q13(b) Explain how a Galvanometer can be converted into an Ammeter of a given range. Derive expression for shunt resistance.

Q13(c) Explain how a Galvanometer can be converted into a Voltmeter of a given range. Derive expression for high resistance connected in series with it.

Q14 A Galvanometer of resistance 10Ω shows full scale deflection for a current of 25 mA. How will you convert it into (i) Ammeter of range 20 A and (ii) Voltmeter of range 120 Volt.

Q15 Distinguish between Diamagnetic, paramagnetic and ferromagnetic substances in respect of (i) Intensity of magnetization (ii) Behaviour in a non-uniform magnetic field and (iii) Susceptibility.

Q16 State Lenz's law. Give an example to illustrate this law. Lenz's law is a consequence of the law of conservation of energy. Justify your answer.

Q17 Distinguish between self-induction and mutual induction.

Q18 If a rate of change of current of 4 A/s induces an emf of 20 mV in a solenoid, what is the self-inductance of the solenoid.

Q19 The mutual inductance of two coaxial coils is 2 H. Current in one coil is changed uniformly from zero to 0.5 A in 100 ms. Find the (i) change in magnetic flux through the other coil and (ii) emf induced in the other coil during the change.

Q20 Using Phasor diagram, derive expression for impedance and phase angle of a series LCR circuit.

Q21 Discuss Principle, construction and working of an AC generator. Derive expression for induced emf and current.

Q22(a) Discuss Principle, construction and working of a Transformer.

Q22(b) The output voltage of an ideal transformer connected to a 240 V a.c.mains is 24 V. When this transformer is used to light a bulb with rating 24 V, 24 W, calculate the current in the primary coil of the circuit.

Q23 A sinusoidal voltage of peak value 10 V is applied to a series LCR circuit in which resistance, capacitance and inductance have values of 10Ω , $1\mu\text{F}$ and 1 H respectively. Find (i) peak voltage across the inductor at Resonance and (ii) Quality factor of the circuit.

Q24 Explain the inconsistency in the Ampere Circuital law. How the concept of displacement current resolved this inconsistency.

Q25 Briefly explain how is an accelerating charge a source of an electromagnetic wave. Name the main parts of electromagnetic spectrum giving their frequency range and source of production. Also give their uses.

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ENGLISH

1. The Last Lesson & Lost Spring both texts highlight the denial of opportunities (education and childhood). How do Alphonse Daudet and Anees Jung show the consequences of neglecting these basic rights?
2. William Douglas describes his struggle against fear. How does his experience prove that courage is not the absence of fear but the ability to overcome it?
3. Selma Lagerlöf suggests that kindness can transform even the most hardened soul. How does the story illustrate redemption through compassion?
4. Kamala Das captures the fleeting nature of life through the image of her aging mother. How does the poet use imagery and contrast to convey both personal fear and universal truth about mortality?
5. Both John Keats in *A Thing of Beauty* and Pablo Neruda in *Keeping Quiet* emphasize the need for harmony in human life. Compare how Keats uses the idea of beauty as a source of solace, while Neruda advocates silence and introspection as a path to peace.
6. Both Jack Finney and Kalki use irony to highlight human flaws—Finney through Charley's escapist fantasy in *The Third Level* and Kalki through the Maharaja's obsession with fate in *The Tiger King*. Discuss how irony shapes the central message in these two stories.
7. Tishani Doshi's *Journey to the End of the World* blends personal reflection with environmental concerns. How does the Antarctic setting serve as both a literal journey and a metaphor for the urgent need to protect our planet?
8. You are Aditi/Adiya Kumar Coordinator of Bhartiya Vidya Bhawan, New Delhi. Draft a formal invitation inviting the Chief Guest Ms. Arundhati Roy, renowned Indian author to inaugurate your school's annual cultural fest 'SYMPHONY'
9. You are Naman/Namya Thakur. You came across an advertisement for the post of a fashion designer in MM Syles Pvt Ltd, 18A, Gurunanak Road, Bandra West, Mumbai, Maharashtra 400050. Write a job application for the post highlighting your qualifications and experience.
10. You are Shivam/Shivika Arora. As incharge of Health and Wellbeing Club of St. Anthony's School, New Delhi. Compose an article on the importance of mental health awareness among teenagers.

OR

You are Rohan/Rohini Verma Cultural Head of Apex Public School. Prepare a report on the successful conduct of your school's annual sports day.

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MATHEMATICS

- Q1. Show that the function given by $f(x) = (\log x)/x$ has maximum at $x = e$.
- Q2. The two equal sides of an isosceles triangle with fixed base b are decreasing at the rate of 3 cm per second. How fast is the area decreasing when the two equal sides are equal to the base?
- Q3. Find the intervals in which the function $f(x) = (4 \sin x - 2x - x \cos x)/(2 + \cos x)$ is (i) increasing (ii) decreasing.
- Q4. Find the intervals in which the function $f(x) = x^3 + 1/x^3$, $x \neq 0$ is (i) increasing (ii) decreasing.
- Q5. Find the maximum area of an isosceles triangle inscribed in the ellipse $x^2/a^2 + y^2/b^2 = 1$, with its vertex at one end of the major axis.
- Q6. A tank with rectangular base and rectangular sides, open at the top, is to be constructed so that its depth is 2 m and volume is 8 m^3 . If building the tank costs Rs 70 per sq. metre for the base and Rs 45 per sq. metre for the sides, what is the cost of the least expensive tank?
- Q7. The sum of the perimeter of a circle and square is k . Prove that the sum of their areas is least when the side of the square is double the radius of the circle.
- Q8. A window is in the form of a rectangle surmounted by a semicircular opening. The total perimeter is 10 m. Find the dimensions for maximum area.
- Q9. A point on the hypotenuse of a triangle is at distances a and b from the sides. Show that the minimum length of the hypotenuse is $(a^{2/3} + b^{2/3})^{3/2}$.
- Q10. Find the points at which $f(x) = (x-2)^4(x+1)^3$ has (i) local maxima (ii) local minima (iii) point of inflexion.
- Q11. Find the absolute maximum and minimum values of $f(x) = \cos^2 x + \sin x$, $x \in [0, \pi]$.
- Q12. Show that the altitude of the right circular cone of maximum volume inscribed in a sphere of radius r is $4r/3$.
- Q13. Let f be defined on $[a, b]$ such that $f'(x) > 0$ for all $x \in (a, b)$. Prove that f is increasing on (a, b) .
- Q14. Show that the height of the cylinder of maximum volume inscribed in a sphere of radius R is $2R/\sqrt{3}$. Also find the maximum volume.
- Q15. Show that the height of the cylinder of greatest volume inscribed in a right circular cone of height h and semi-vertical angle α is $h/3$ and the greatest volume is $(4/27)\pi h^3 \tan^2 \alpha$.

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COMPUTER SCIENCE

1. Anant has been asked to display all the students who have scored less than 40 for remedial classes. Write a user defined function to display all those students who have scored less than 40 from the binary file 'student.dat'.
2. Write a Python program that:
 - Accepts the user's age as input.
 - Handle the following exceptions:
ValueError if the user enters a non-numeric value.
Raise a ValueError if the age entered is less than 0 or greater than 120.
 - If the input is valid, display:
"Your age is valid."
 - Use a finally block to print:
"Thank you for using the program."
3. Write function in Python, do_push(Num) and do_pop(Num), to add a new number and delete a number from a list of numbers, considering them to act as push and pop operations of the stack data structure.
4. Create a CSV file 'Groceries' to store information of different items existing in a shop. The information is to be stored w.r.t each item code, name, price, qty. Write a program to accept the data from user and store it permanently in CSV file.
5. Write a python function that accepts a string and calculates the number of uppercase and lowercase letters.
6. Write a program to store student names and their percentage in a dictionary and delete a particular student name from the dictionary. Also display the dictionary after deletion.
7. Write a user defined function to accept string as an input and to count and display the total number of times a character is present.
8. Write a Python program that:
 - Accepts two numbers from the user.
 - Divides the first number by the second number.
 - Handle the following exceptions:
ValueError if the user enters non-numeric input.
ZeroDivisionError if the second number is zero.
 - If the division is successful, display the result.
 - Use a finally block to print:
"Program ended successfully."
9. Write AddCustomer(Customer) and DeleteCustomer(Customer) methods in Python to add a new customer and delete a customer from a list of CustomerNames, considering them to act as push and pop operations of the stack data structure.
10. Write a program to shift elements of a list so that the first element moves to the second index and second index moves to the third index, and so on, and the last element shifts to the first position. Suppose the list is [10,20,30,40]
After shifting, it should look like: [40,10,20,30]