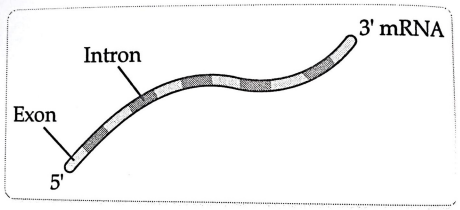
# NEW STANDARD ACADEMY

**Marks: 60**

**Date : 06-01-25** **CLASS : 12TH** **Time: 2 HRS**

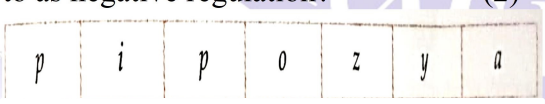
## BIOLOGY

1. Observe the segment of mRNA given here.
   (a) Explain and illustrate the steps involved to make fully processed hnRNA?
   (b) Gene encoding RNA Polymerase I and III has been affected by mutation in a cell. Explain its impact on the synthesis of a polypeptide, stating reasons. (2)

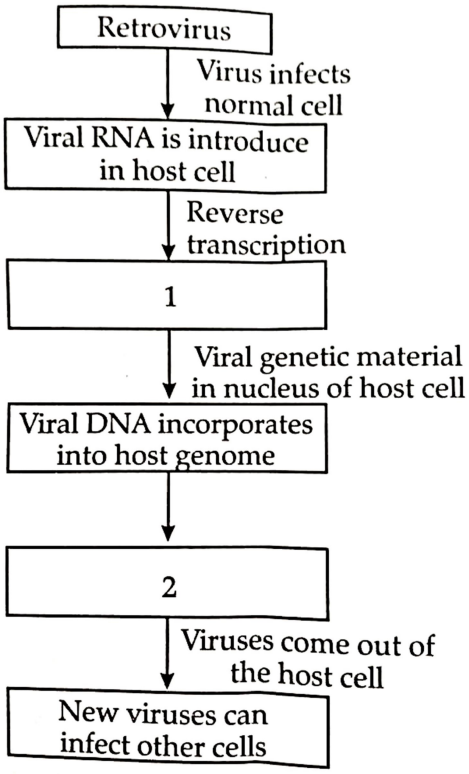



2. Construct and lebel a transcription unit from which the RNA segment given below has been transcribed .Write the complete name of the enzyme that transcribed this RNA.


3. Study the schematic representation of the genes involved in the lac operon given below and answer the questions that following
   (a) Identify and name the regulatory gene in this operon. Explain its role in 'switching off' the operon.
   (b) Why is lac operon's regulation referred to as negative regulation? (2)




4. In the given flow diagram, the replication of retrovirus in a host is shown. (2)



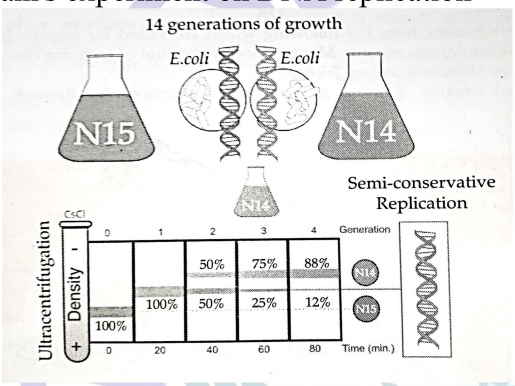

   Observe and answer the following questions.
   (a) Fill in 1 and 2
   (b) Why is the virus called retrovirus?

5. How and why is charging of tRNA essential in the process of translation?(2)
6. A DNA sequence needed for coding a peptide is given below.
   CAAGTAAATTGAGGACTC
   Codon hints:
   UUA-Leu
   CCU-Pro
   CAU-His
   ACU-Thr
   GUU-Val
   GAG-Glu
   (a) Write the complementary mRNA coding sequence for this.
   (b) Find out the amino acid sequence of the peptide chain using the codons given in the hints.

(c) If a mutation cause a change in the sixth codon CTC to CAC. It leads to a Mendelian disorder. Identify the disease (3)

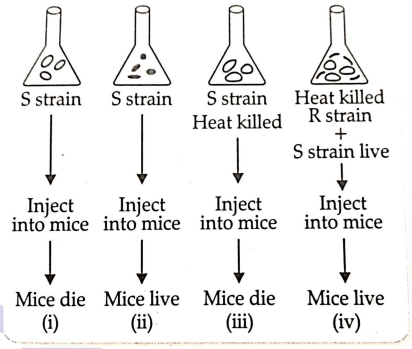
7. Human Genome Project (HGP) was a mega project launched in the year 1990 with some important goals.
   (a) Enlist any four prime goals of HGP.
   (b) Name any one common non-human animal model organism which has also been sequenced thereafter (3)
   (3)

8. The diagram below represents Meselson and Stahi's experiment on DNA replication



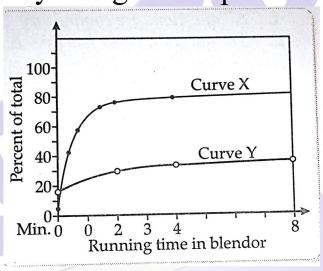

For several generations, E. coli was grown in a medium containing an isotope of nitrogen, "N. DNA was extracted periodically, at successive generations, and it was subjected to ultracentrifugation to check the percentage of the isotope that was transmitted across generations.
a) How did the centrifugation process helps in providing evidence of the nature of DNA replication?
(b) Which mode of replication did the Messelson and Stahl's experiment support?
(c) How are semi-conservative and conservative modes of replication different?
(d) What happens if DNA replication goes wrong? (3)

9. Study the given diagrammatic representation of Griffith's experiment to demonstrate transformation in bacteria.
   (a) Which of these (i), (ii), (iii) and (iv) is incorrectly representing the experiment?
   (b) Comment on the significance of the results obtained.
   (3)




10. (a) State the function of the ribosome as a catalyst in bacteria during the process of translation.
    (b) Explain the process of binding of ribosomal units to mRNA during protein synthesis (3)

11. Hershey and Chase performed several experiments to find the chemical nature of the genetic material that is present in all organisms. The graph below shows the results of one such experiment. It tracks the amount of 32P and 35S found in the supernatant after the bacterial cell suspension was agitated in a blender. The Y-axis represents the percentage of radioactivity from 32P and 35S each as compared to all radioactivities detected the in the supernatant.
    (a) What did Hershey and Chase want to verify using this experiment?




(b) What do curves X and Y represent? Give a reason to support your answer.
(c) Write the observations and the conclusions they arrived at. (5)

## CHEMISTRY

1. Although + 3 oxidation states is the characteristic oxidation state of lanthanoids but cerium shows + 4 oxidation state also. Why? (2)
2. Calculate the number of unpaired electrons in the following gaseous ions $Mn^{3+}$,

$Cr^{3+}$,$v^{3+}$and $Ti^{+3}$ which one of these is the most stable in aqueous solution? (2)

3. Why is $Cr^{2+}$ reducing and $Mn^{3+}$ oxidising when both have d' configuration. (2)
4. Which is a stronger reducing agent $Cr^{2+}$ or $Fe^{+2}$ and why? (2)
5. (a) Compare the chemistry of the actinoids with that of lanthanoids with reference to the following:
   (i) electronic configurations,
   (ii) oxidation states,
   (iii) chemical reactivity. (3)
6. Explain the following observations:
   (i) Many of the transition elements are known to form interstitial compounds.
   (ii) There is a general increase in density from titanium (Z = 22) to copper (Z = 29)
   (iii) The numbers of the actinoid series exhibit a larger number of oxidation states than the corresponding members of the lanthanoid series. (3)
7. Predict which of the following will be coloured in aqueous solution?
   $Ti^{3+}$, $V^{3+}$, $Sc^{3+}$, $Mn^{2+}$, $Fe^{3+}$, $Co^{2+}$ and $MnO_4^-$ (3)
8. (i) For $M^{2+}$/ M and M $^{3+}$ / $M^{2+}$ systems, $E^0$ values for some metals are as follows:
   $Cr^{2+}$ / Cr = - 0.9V $Cr^{3+}$ /$Cr^{2+}$ = - 0.4V
   $Mn^{2+}$ / Mn = - 1.2V $Mn^{3+}$/$Mn^{2+}$ =+ 1.5V
   $Fe^{2+}$ / Fe = - 0.4V $Fe^{3+}$ /$Fe^{2+}$ =+ 0.8V
   Use this data to comment upon
   (a) the stability of F $e^{3+}$ in acid solution as compared to that of C $r^{3+}$ and M $n^{3+}$
   (b) the ease with which iron can be oxidised as compared to the similar process for either Cr or Mn metals (3)
9. A violet compound of manganese (A) decomposes on heating to liberate oxygen and compounds (B) and (C) of manganese are formed. Compound (C) with reacts KOH in the presence of potassium nitrate to give compound (B). On heating compound (C) with conc. $H_2SO_4$ and NaCl, chlorine gas is liberated and a compound (D) of manganese along with other products is formed. Identify compounds A to D and also explain the reactions involved. (5)
10. (i) Name the element of 3d transition series which shows maximum number of oxidation states. Why does it show so?
    (ii) Which transition metal of 3d series has positive $E^0$ ($M^{2+}$ /M) value and why ?
    (iii) Out of $Cr^{3+}$ and $Mn^{3+}$ which is a stronger oxidizing agent and why?
    (iv) Name a member of the lanthanoid series which is well known to exhibit + 2 oxidation state.
    (v) Complete the following equaton:
    $MnO^-_4 + 8H^+ + 5e^-. \rightarrow$ (5)

## MATHS

1. The degree of the differential eq$^n$ $\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0$ is
2. Form a differential eq$^n$ representiy the given family of curres by eliminatiy arbitrary constents ‘a’ and ‘b’.
   $Y = e^{2x}(a+bx)$
3. Formthe defferential eq$^n$of the family of ellipses having foci on axis and centre at orisin.
4. Find the general solution $sec^2x\ tany\ dx + Sec^2ytanx\ dy = 0$
5. Find the eq$^n$ of a curve passing through the point(0,0) and whose defferenfical equation is $y^x = e^x \sin x$.
6. Solve $(x^2+xy)\ dy = (x^2+y^2)\ dx$
7. Find the particular solution satisfying the given condition.
   $(x+y)\ dy + (x-y)dx = 0, y = 1$,when
8. Find the general solution $\frac{dy}{dx} + 2y = sinx$
9. Prove that $x^2-y^2 = c(x^2+y^2)^2$ is the general solution of differential equation $(x^3-3x\ y^2)\ dx = (y^3-3x^2y)\ dy$ , where c is a parameter.
10. Find the particular solution of the differential eq$^n$ $(1+e^{2x})\ dy + (1+y^2)\ e^x dx = 0$ give that y= 1 when x = 0