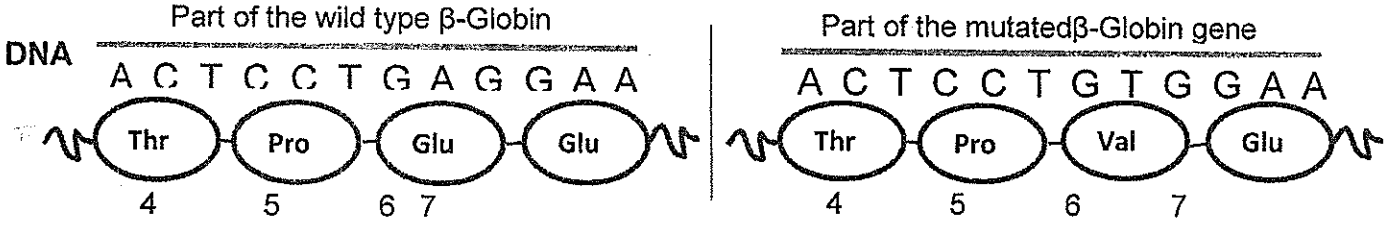
ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE 560027
B.Sc BIOTECHNOLOGY - III SEMESTER
MID SEMESTER TEST - AUGUST 2019
BT318: MOLECULAR BIOLOGY AND BIOPHYSICS

Time: 60 Min **Max Marks: 30**

This question paper has **THREE sections** and **TWO printed pages**.

I. Answer **any SIX** of the following questions. **6 X 3 =18 marks**

1. Write a brief note comparing the relative amounts of non-coding DNA in prokaryotic versus eukaryotic genomes.
2. Comment on the processivity of the DNA Polymerase enzyme.
3. In Griffith's experiment where he proved the presence of the 'transforming principle', suppose that the type R strain used by Griffith was resistant to killing by an antibiotic, while the type S strain lacked this trait. For the experiment where he mixed the R strain with the heat killed S strain and injected mice, would you expect the living type S bacteria found in the dead mouse's blood to be resistant to the antibiotic? Defend your argument.
4. Draw a neat diagram of replication fork in *E.coli* and label the following: Lagging strand, Leading strand, Okazaki fragments, RNA primers on the leading strand, RNA primers on the lagging strand and direction of fork movement.
5. The following is a representation of change in DNA sequence in the beta globin gene, which results in sickle cell anaemia. Describe the type of mutation and its effects.



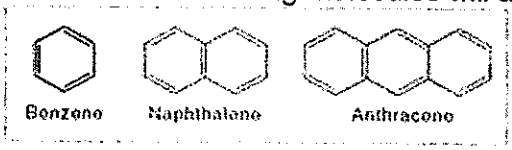
6. Describe how thymine dimers can be repaired in prokaryotic and eukaryotic systems.
7. To separate which of the following components, you may need to use an ultracentrifuge: chloroplast from plant cells, ribosomes from yeast, cheek cells from saliva, lysosomes from liver cells. Explain your answer based on the formula for sedimentation rate.
8. Before going for lunch, your lab teacher asked you to centrifuge mitochondria at a relative centrifugal force of 12,000 g for 15 minutes. Your lab centrifuge does not show any settings for rcf and has a rotor of radius 12 cm. At what speed will you perform the centrifugation?
9. Briefly explain with diagrams: How will you separate glucose-binding proteins from a mixture of cell proteins?

II. Answer **all parts of any ONE** of the following questions. **1X 6 = 6 marks**

10. Answer the following questions about chromatography :
a. What is the stationary phase used in thin-layer chromatography (TLC). Is it polar or non-polar?
b. Given a mixture of amino acids, how will you separate polar and non-polar amino acids using TLC. What type of mobile phase will you use? Why?
c. Will you be able to see the separated amino acids on the TLC plate? If not, what will you do to confirm the separation?

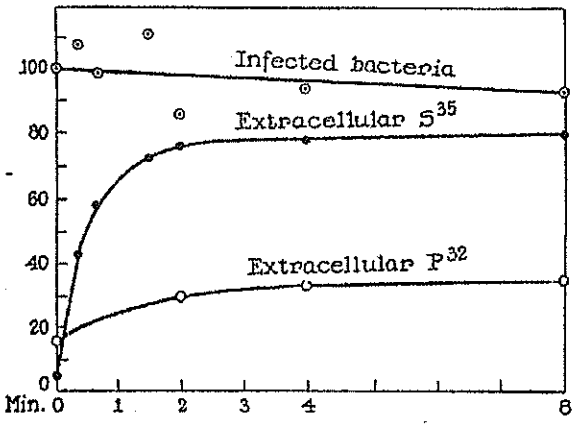
d. Using your answers for a and b, draw a TLC plate with 2 spots: one with polar amino acids and another with non-polar amino acids.
e. If you use column chromatography for the same purpose, what will be the advantages?

11. Answer the following questions about spectroscopy
a. Why do sigma bonding orbitals and pi bonding orbitals absorb EM waves of different wavelengths?
b. If λ_{max} for molecule X is approx 430 nm, draw an absorption spectrum showing absorption of light by the molecule X at different wavelengths?
c. The absorbance at 280 nm (A_{280}) of 1 M solution of protein A was 0.5, whereas for 1M solution of protein B, it was 1.2. What may be the difference between the two proteins? Explain your answer in very brief.
d. Which of the following molecules will absorb the lowest wavelength of light? Why?



III. Answer **all parts of any ONE** of the following questions. **1 X 6 = 6 marks**

12. The following graph shows data from Hershey and Chase's experiment that conclusively proved that DNA is the genetic material. On the X axis is **Agitation time in the blender**and on the Y axis is **Percentage of isotope in the supernatant.**



a. Using a flowchart, describe the Hershey and Chase experiment.
b. Draw a similar graph with values you would expect to see in the bacterial pellet.
c. Write inferences based on the graph you draw.

13. In bacterial DNA replication, what do you think would be the impact of missense mutations in the following genes:
a. One of the 13 bp motifs in the ori C.
b. dna B gene
c. dna E that codes for the αsubunit of the Core Polymerase assembly
d. dna N gene that codes for the β clamp subassembly
e. dna Q gene that codes for the ε subunit with the 3'-5' exonuclease activity
f. one of the terminator sequences