2009 Division C
Cell Biology Event

Team Name: _____

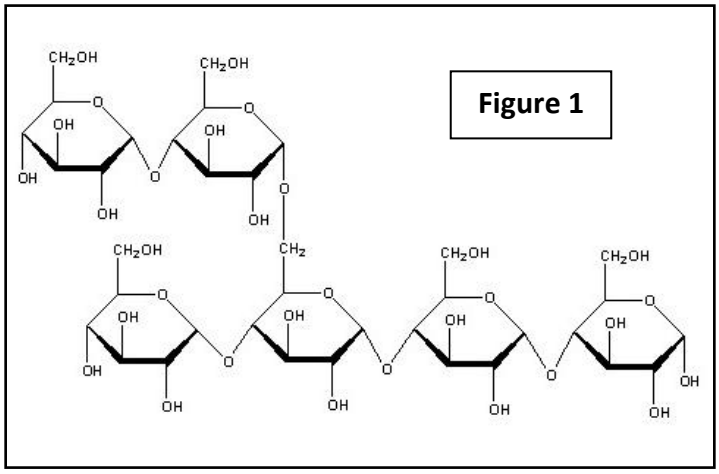
Score: _____

Exploring the World of Science

Instructions: Carefully read each question.

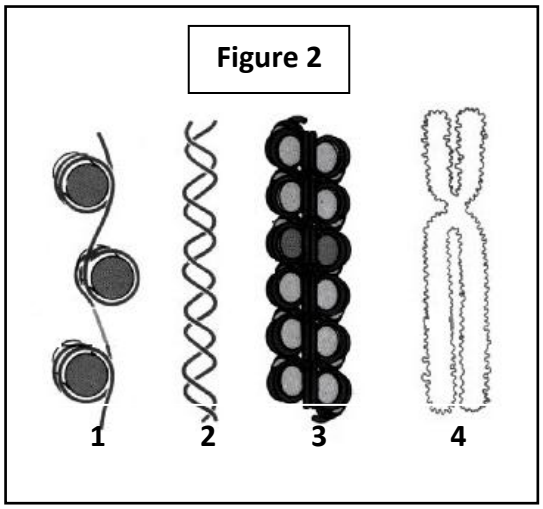
Section A: Select the best answer for each multiple choice question. Clearly mark your selection by circling the answer and by filling in the bubble corresponding to your selection on the bubble sheet.

1. What monosaccharide subunits form the molecule in Figure 1?
   - **a.** Fructose
   - **b.** Maltose
   - **c.** Sucrose
   - **d.** Glucose
   - **e.** Lactose

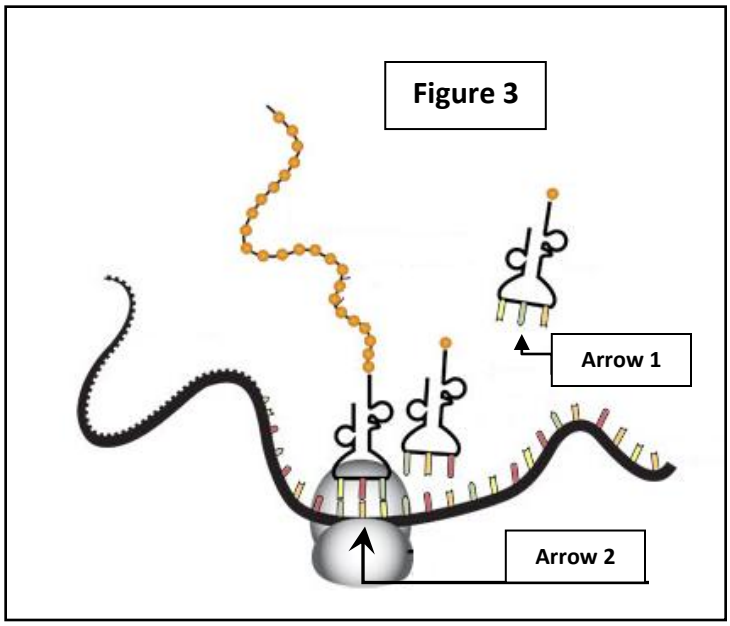


2. What enzyme hydrolyzes the polysaccharide in Figure 1?
   - **a.** Amylase
   - **b.** Pepsin
   - **c.** Trypsin
   - **d.** Fructase
   - **e.** Kinase

3. Which structure in Figure 2 represents the most compacted form of nucleic acid?
   - **a.** 1
   - **b.** 2
   - **c.** 3
   - **d.** 4



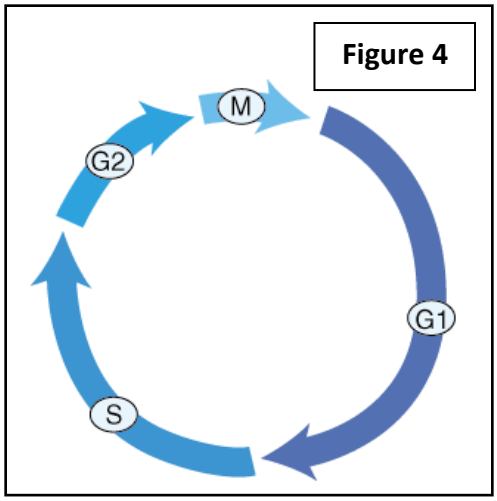
4. In Figure 3, what is the name of the region of the molecule designated by the Arrow 1?
    - **a.** Amino acid hook
    - **b.** Antidote
    - **c.** Anticodon
    - **d.** rRNA



5. In what part of the cell would the molecules shown in Figure 3 be found interacting?
    - **a.** Lysosome
    - **b.** Rough endoplasmic reticulum
    - **c.** Golgi apparatus
    - **d.** Stroma
    - **e.** Nucleus

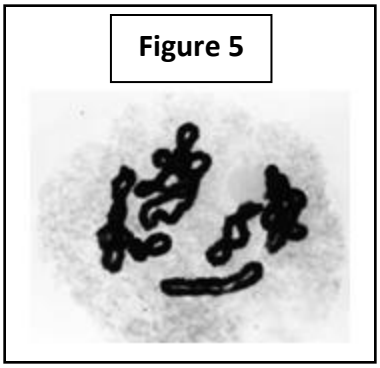
6. In Figure 3, what, designated by Arrow 2, is being "read"?
    - **a.** Codon
    - **b.** DNA
    - **c.** Ribosome
    - **d.** Intron
    - **e.** tRNA

7. Replication of DNA occurs in which of the cell phases indicated in Figure 4?
    - **a.** M
    - **b.** G1
    - **c.** S
    - **d.** G2



8. Which of the cell phases indicated in Figure 4 takes the least amount of time for completion?
    - **a.** M
    - **b.** G1
    - **c.** S
    - **d.** G2

9. Which phase of mitosis is represented in Figure 5?
    - **a.** Metaphase
    - **b.** Prophase
    - **c.** Telophase
    - **d.** Anaphase



10. In Figure 6, _____ is designated by 1.
    - **a.** Nucelosome
    - **b.** Centromere
    - **c.** Spindle
    - **d.** Telomere
    - **e.** Chromatid

11. In Figure 6, _____ is designated by 2.
    - **a.** Centromere
    - **b.** Telomere
    - **c.** Kinetochore
    - **d.** Spindle
    - **e.** Cyclin

12. In Figure 6, _____ is designated by 3.
    - **a.** Centromere
    - **b.** Spindle
    - **c.** Chromatid
    - **d.** Ribosome
    - **e.** Histone

13. _____ is represented in Figure 7; this stage of mitosis comes _____ cytokinesis.
    - **a.** Anaphase; after
    - **b.** Telophase; before
    - **c.** Anaphase; before
    - **d.** Telophase; after
    - **e.** None of the above

14. A _____ is represented by Figure 8.
    - **a.** Bacterium
    - **b.** Mitochondrion
    - **c.** Bacteriophage
    - **d.** Macrophage
    - **e.** Protist

15. The agent shown in Figure 8 targets members of the Kingdom _____.
    - **a.** Plantae
    - **b.** Animalia
    - **c.** Protista
    - **d.** Fungi
    - **e.** Monera

Figure 6

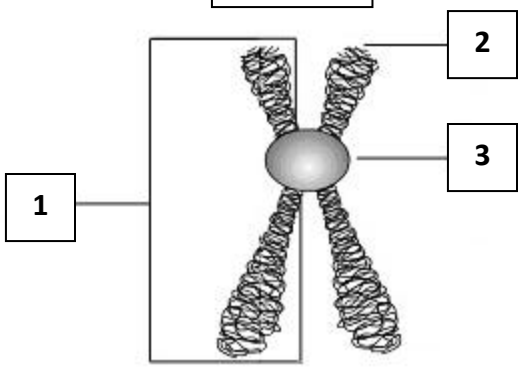


Figure 7

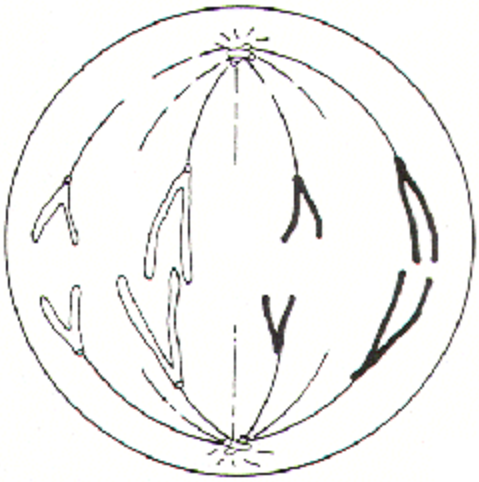
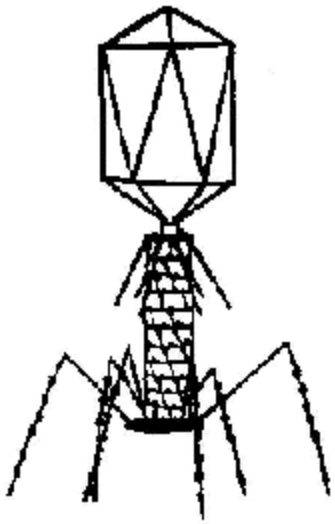


Figure 8



16. Agents similar to the illustration in Figure 8 were used in classic experiments by _____.
    - **a.** Hershey and Chase
    - **b.** Watson and Crick
    - **c.** Einstein
    - **d.** Griffith
    - **e.** None of the above

17. Which of the following is true of an enzyme that has been denatured?
    - **a.** Its primary structure has not been disrupted
    - **b.** It is still able to catalyze reactions
    - **c.** It is capable of lowering the activation energy of a reaction
    - **d.** Its active site can be used to bind a ligand
    - **e.** Is has acquired quaternary structure

18. Which of the following traits do prokaryotes and eukaryotes have in common?
    - **a.** A single chromosome encodes the entire genome
    - **b.** Circular chromosomes
    - **c.** Bidirectional replication
    - **d.** Comparable DNA molecular weight
    - **e.** Equal numbers of origins of replication

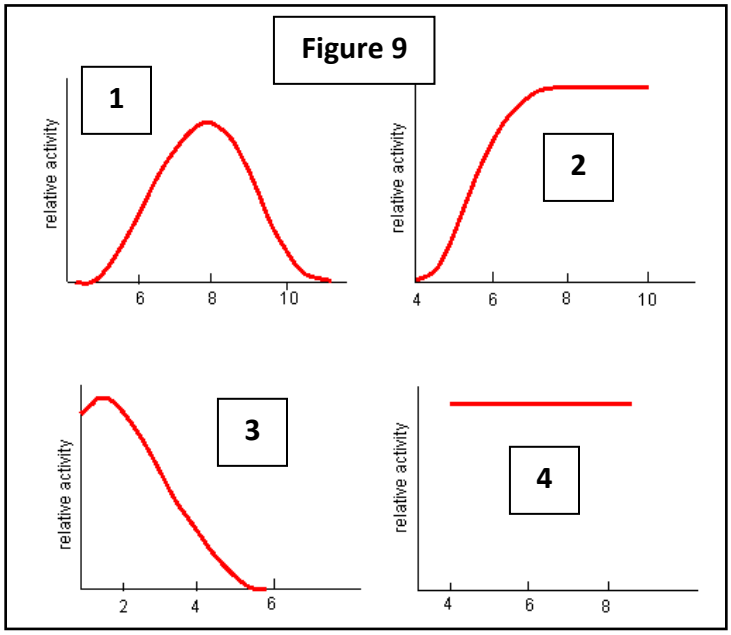
19. Cancer cells grown in culture are <u>dissimilar</u> to normal cells grown in culture in that they
    - **a.** Divide a finite number of times
    - **b.** Do not display contact inhibition
    - **c.** Proliferate to low cell density
    - **d.** Require higher levels of growth factors for proliferation
    - **e.** Demonstrate greater adherence to surfaces

20. Which of the following is <u>not</u> a characteristic of introns?
    - **a.** They occur only in eukaryotes
    - **b.** They represent noncoding regions
    - **c.** They are found interspersed with exons on a region of DNA coding for a polypeptide
    - **d.** They are excised from the transcript before addition of the 5'cap and 3' poly(A) tail
    - **e.** They are transcribed along with exons to create the primary transcript

21. A frameshift mutation is created when
    - **a.** An initial mutation is reversed by a second mutation
    - **b.** Telomeres are removed
    - **c.** A codon's nucleotide sequence changes so that it calls for production of a different amino acid than the original one
    - **d.** A codon's nucleotide sequence changes so that instead of coding for a given amino acid it acts to terminate translation
    - **e.** A base pair is either inserted or deleted in a gene

22. In Figure 9, graph _____ is indicative of an enzyme which has evolved to be most active at an acidic pH.
    - **a.** 1
    - **b.** 2
    - **c.** 3
    - **d.** 4

23. In Figure 9, graph _____ represents an enzyme which demonstrates low catalytic activity at extreme pHs.
    - **a.** 1
    - **b.** 2
    - **c.** 3
    - **d.** 4



24. Noncovalent bonds include all of the following except:
    - **a.** A carbon-carbon double bond
    - **b.** An ionic bond
    - **c.** A hydrogen bond
    - **d.** A van der Waals interaction

25. Which of the following describes a primary property of enzymes?
    - **a.** They contain platinum
    - **b.** They lower the activation energy of a reaction
    - **c.** They decrease the rate of a reaction
    - **d.** They bind to a variety of substances

26. What feature of a protein can predict its function?
    - **a.** Number of amino acids
    - **b.** Net charge
    - **c.** Molecular weight
    - **d.** Structure

27. The percentage of G-C base pairs in a DNA molecule is related to the T_m because
    - **a.** The stability of pairing is distinct between G-C and A-T
    - **b.** A-T base pairs require a higher temperature for denaturation
    - **c.** Two hydrogen bonds exist between G-C
    - **d.** The G-C content is equal to the A-T content

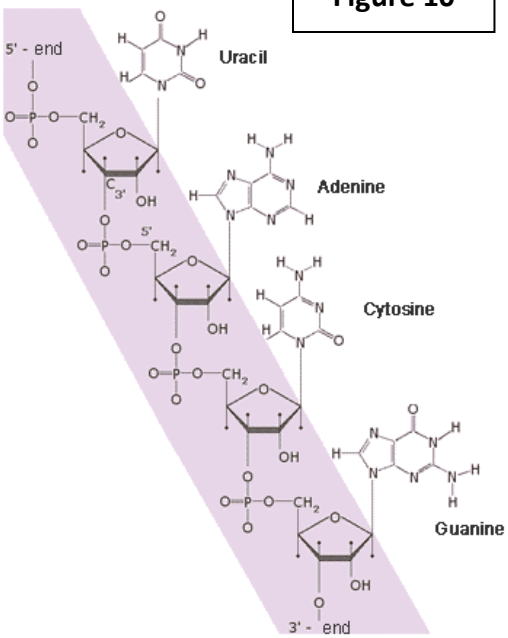
28. Which macromolecule is incorrectly matched with its monomer?
    - **a.** Polysaccharide - Simple sugar
    - **b.** Protein – Nucleotide
    - **c.** Fat – glycerol
    - **d.** Polypropylene – propylene

29. Which of the following techniques or pieces of equipment is mismatched with a possible use?
    - **a.** Electrophoresis - Separating proteins
    - **b.** Chromatography – Separating pigments
    - **c.** Centrifugation – Examining the surface of cells
    - **d.** Spectrophotometer – Determining how much of a colored product is produced

30. Meiosis results in _____ functional egg(s) and _____ polar bodies.
    - **a.** Four, zero
    - **b.** Three, one
    - **c.** Two, two
    - **d.** One, three

31. The molecule represented in Figure 10 cannot be DNA because
    - **a.** The molecule is double-stranded
    - **b.** The molecule contains uracil
    - **c.** The molecule contains ribose
    - **d.** Both A and B
    - **e.** Both B and C

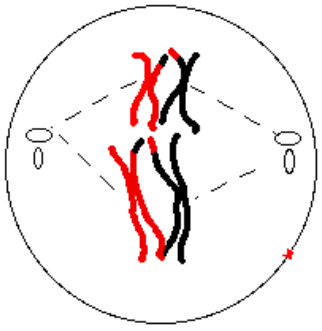
Figure 10



32. In photosynthesis, _____ and _____ produced in the light-_____ reactions, are required for the light-_____ reactions.
    - **a.** ATP; NADPH; dependent; independent
    - **b.** ATP; NADPH; independent; dependent
    - **c.** O_2; NADPH; independent; dependent
    - **d.** O_2; NADPH; dependent; independent

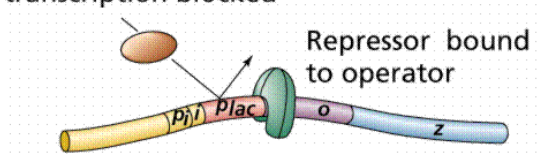
33. Figure 11 represents _____.
    - **a.** Metaphase I of mitosis
    - **b.** Metaphase II of mitosis
    - **c.** Metaphase I of meiosis
    - **d.** Metaphase II of meiosis

Figure 11



34. Figure 12 represents _____ regulation of _____.
    - **a.** Negative; translation
    - **b.** Negative; transcription
    - **c.** Positive; translation
    - **d.** Positive; transcription

Figure 12



35. _____ reactions require an input of energy and are commonly biosynthetic in nature.
    - **a.** Endergonic
    - **b.** Degradative
    - **c.** Exergonic
    - **d.** Spontaneous

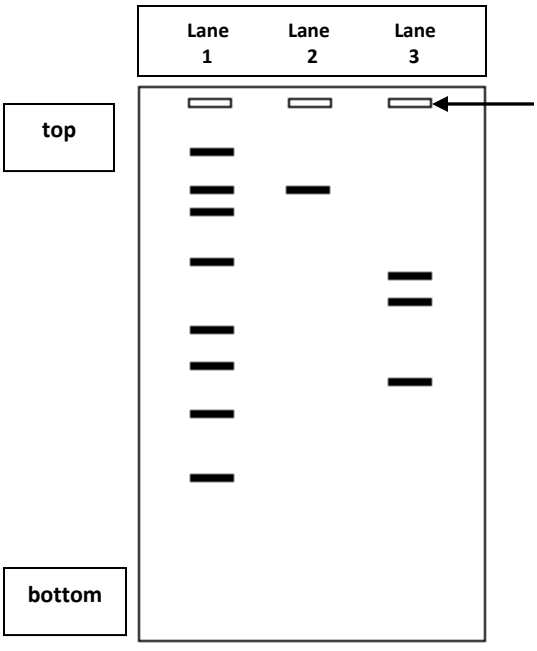
36. In aerobic respiration, the greatest payoff (in terms of ATP production) occurs in the _____ stage of the process called _____.
    - **a.** First; Glycolysis
    - **b.** Second; Kreb's cycle
    - **c.** First; Electron transport phosphorylation
    - **d.** Third; Electron transport phosphorylation
    - **e.** Second; Glycolysis

37. In Figure 13, which represents results of DNA electrophoresis, strands of DNA containing fewer base pairs would be found closer to the
    - **a.** Top
    - **b.** Bottom
    - **c.** Wells
    - **d.** Entrance

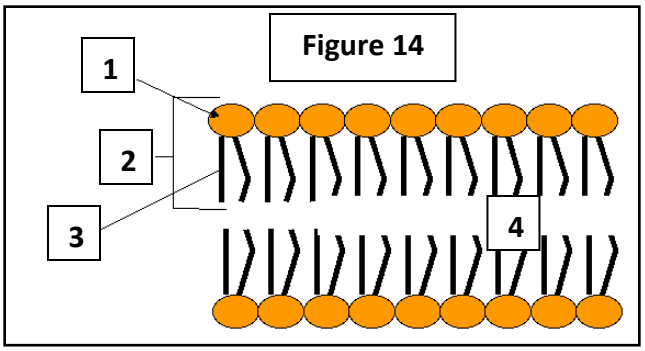
38. In Figure 13, the arrow designates the
    - **a.** Wells
    - **b.** Ladder
    - **c.** Electric field
    - **d.** DNA bands

39. In Figure 13, Lane 1 is the
    - **a.** Test sample
    - **b.** Ladder
    - **c.** Negative control
    - **d.** None of the above

Figure 13



40. In Figure 14, which represents a cell membrane, number 1 designates the _____ which are _____.
    - **a.** Polar heads; hydrophobic
    - **b.** Ionic heads; hydrophobic
    - **c.** Polar heads; hydrophilic
    - **d.** Nonpolar heads; hydrophilic

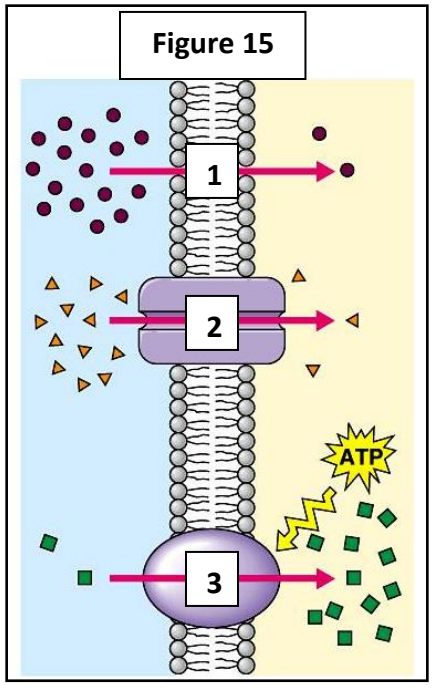


41. In Figure 14, number 2 points to a
    - **a.** Phospholipid
    - **b.** Cholesterol molecule
    - **c.** Polysaccharide
    - **d.** Protein channel

42. In Figure 14, number 3 designates the _____ which are _____.
    - **a.** Tails; nonpolar
    - **b.** Tails; hydrophilic
    - **c.** Heads; hydrophilic
    - **d.** Heads; nonpolar

43. In Figure 14,_____ molecules would have difficulty passing though the section marked by the number 4.
    - **a.** Uncharged
    - **b.** Charged
    - **c.** Hydrophobic
    - **d.** Cholesterol

44. In Figure 15, molecules such as O_2 would be most likely to cross the membrane as described by method ____.
    - **a.** 1
    - **b.** 2
    - **c.** 3



45. In Figure 15, _____ is represented by method 2.
    - **a.** Simple diffusion
    - **b.** Active transport
    - **c.** Facilitated diffusion
    - **d.** Signal transduction

46. In Figure 15, _____ is acting against the concentration gradient.
    - **a.** 1
    - **b.** 2
    - **c.** 3

47. In Figure 15, ___ and ___ are examples of passive transport.
    - **a.** 2 and 3
    - **b.** 3 and 2
    - **c.** 1 and 2
    - **d.** 1 and 3

48. In Figure 16, Arrow 3 designates _____.
    - **a.** Golgi
    - **b.** Mitochondrion
    - **c.** Peroxisome
    - **d.** Mitochondrion
    - **e.** Smooth ER

49. In Figure 16, transcription would take place in the area designated by Arrow _____.
    - **a.** 1
    - **b.** 2
    - **c.** 3
    - **d.** 4

50. In Figure 16, major components of the cytomembrane system are designated by Arrows _____ and _____.
    - **a.** 1 and 2
    - **b.** 1 and 3
    - **c.** 2 and 3
    - **d.** 3 and 4