2010-2011 SC/BIOL 1010 6.0 December Exam - Dec. 14, 2010

Section B [Taught by Dr. Tanya Noel in CSE A] KEY

This test consists of **58 multiple choice items** (including section and version indicators – these do not count in the score but must be completed). There are **15 pages**. This test is **90 minutes** long.

The entire question booklet and your scantron must be submitted to receive a grade. **Indicate your full name and student number on the scantron and on this page. (Please double-check your student number bubbling.)** Be sure to sign the sign-in sheet. **Your name must be written in permanent ink in all places.**

Please **answer all questions on the scantron**. Choose **the single best answer** out of the options for each question. Read each question (and all possible answers) carefully.

Calculators, cell phones, mp3 players and other electronic devices are NOT permitted, and must be put away.

Students are reminded of the Code of Conduct agreement signed at the beginning of the course, in particular: *"I understand York University's Senate Policy on Academic Honesty and will abide by this policy (avoiding cheating, plagiarism and other forms of academic dishonesty)."*

Invigilators reserve the right to move students during the test. This may not reflect any suspicion of you (e.g., someone behind you may be looking at your paper). However, please note that aiding and abetting cheating is considered an academic honesty offense in itself.

If you have not finished by 10:20 AM, you must remain at your seat until the exam is over and your test has been picked up.

Good luck!

Last name	First name
Student number	

Please check that you have bubbled your student number correctly on the scantron.

1. You are in BIOL 1010 **B**. (If you are NOT in Section B of the course, see an invigilator IMMEDIATELY.) Indicate B on the scantron. [This helps us keep things organized!]

   A. No **X**
   B. Pick me!!! ✓
   C. No **X**
   D. No **X**
   E. No **X**

2. You have exam version **B**, which must be indicated on the scantron to get credit for test questions.

   A. No **X**
   B. Pick me!!! ✓
   C. No **X**
   D. No **X**
   E. No **X**

3. During _____ , solutes are moved across the plasma membrane against their concentration gradient.

   A. simple diffusion
   B. endocytosis
   C. facilitated diffusion
   D. osmosis
   E. **active transport**.

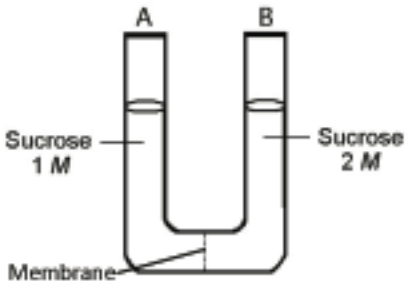
4. Certain organisms such as the striped bass (*Morone saxatilis*) are able to migrate between the ocean (i.e., saline water) and freshwater streams. Consider when the striped bass migrates **into** freshwater streams (from the saline waters); which one of the following situations would be necessary to maintain life?

   A. The plasma membrane of the organism must change its phospholipid composition.
   B. Cholesterol levels of the plasma membrane must be increased.
   C. **Ions must be kept within the cells while water is kept out**.
   D. Water must be kept within the cells while ions are kept out.

5. What are the membrane structures that function in active transport?

   A. **integral proteins**.
   B. peripheral proteins
   C. phospholipid fatty acid tails
   D. cholesterol deposits
   E. cytoskeletal elements

Use the following information to answer the next two questions.



You have two chambers of liquid separated by a semipermeable membrane that does not permit sugars to cross, but is permeable to water. Initially, Side A contains a 1M sucrose solution; Side B contains an equivalent volume of a 2M sucrose solution.

6. Side A is initially _____ to Side B.

   A. hypertonic
   B. isotonic
   C. **hypotonic**.

7. After enough time has passed for the system to reach equilibrium, what would you expect to see regarding the level of the solution on each side?

   A. Volume increase (higher level) on Side A.
   B. **Volume increase (higher level) on Side B**.
   C. No change would be observed in solution level on either side.

The next two questions are based on the following information.

A series of enzymes catalyze the reaction X → Y → Z → A. Substance A binds to the enzyme that converts X to Y at a position remote from its active site. This binding decreases the activity of the enzyme.

8. Substance A functions as

   A. an allosteric activator.
   B. a competitive inhibitor.
   C. a coenzyme.
   D. **an allosteric inhibitor**.
   E. a reactant.

9. What is substance X?

   A. **a reactant**.
   B. a competitive inhibitor.
   C. a coenzyme.
   D. an allosteric inhibitor.

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10. Which of the following statements is/are true about enzyme-catalyzed reactions?

    A. The reaction always goes in the direction toward chemical equilibrium.
    B. **The reaction is faster than the same reaction in the absence of the enzyme**.
    C. The free energy change of the reaction is opposite (+/-) from the reaction in the absence of the enzyme.
    D. B and C only.
    E. A, B, and C.

11. Increasing the substrate concentration in an enzymatic reaction could overcome which of the following?

    A. insufficient cofactors
    B. denaturization of the enzyme
    C. allosteric inhibition
    D. **competitive inhibition**.
    E. saturation of the enzyme

12. The skeletal and heart muscles and the brain are typically the regions most affected in people with mitochondrial disorders. Which of the following best explains why this is so?

    A. They have fewer mitochondria in the cell compared to those of other tissues.
    B. They are the most important organs.
    C. **They have the highest energy needs**.
    D. They are generally very fragile.
    E. They have the most extensive endomembrane systems of all cells.

13. Where are the protein complexes of the respiratory electron transport chain located?

    A. mitochondrial intermembrane space
    B. mitochondrial matrix
    C. cytosol
    D. mitochondrial outer membrane
    E. **mitochondrial inner membrane** .

14. Which of the following statements describes the results of this reaction?

$$C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O + \text{Energy}$$

    A. $C_6H_{12}O_6$ is reduced and CO_2 is oxidized.
    B. O_2 is reduced and CO_2 is oxidized.
    C. **$C_6H_{12}O_6$ is oxidized and O_2 is reduced**.
    D. O_2 is oxidized and H_2O is reduced.
    E. CO_2 is reduced and O_2 is oxidized.

15. ATP synthase

A. is a component of the electron transport chain.
B. is used to generate ATP in cellular respiration, but hydrolyzes ATP for the energy to perform active transport in photosynthesis.
C. performs a similar function in cellular respiration and photosynthesis, but is of very different structure and biochemical composition in the different processes.
D. **is an enzyme that is a tiny rotary motor**.

16. Following glycolysis and the Krebs cycle and before the electron transport chain and oxidative phosphorylation, the carbon skeleton of glucose has been broken down to CO_2. Most of the energy from the original glucose at that point is in the form of _____.

A. CO_2.
B. H_2O.
C. **NADH**.
D. ATP.

17. Which of the following is/are true of **all** of the following: substrate-level phosphorylation, oxidative phosphorylation and photophosphorylation?

A. Pigment molecules are required.
B. **ATP is synthesized from ADP and inorganic phosphate**.
C. Energy is harnessed to drive the process through movement of electrons down an electron transport chain.
D. An electrochemical or chemiosmotic gradient of protons (H^+) across the inner mitochondrial membrane is required.

18. The majority of the G3P produced during the Calvin cycle is used to make

A. **RuBP to continue the cycle**.
B. Rubisco
C. NADPH
D. glucose
E. ATP to continue the cycle

19. Which of the following is true regarding different pathways for carbon fixation in certain plants?

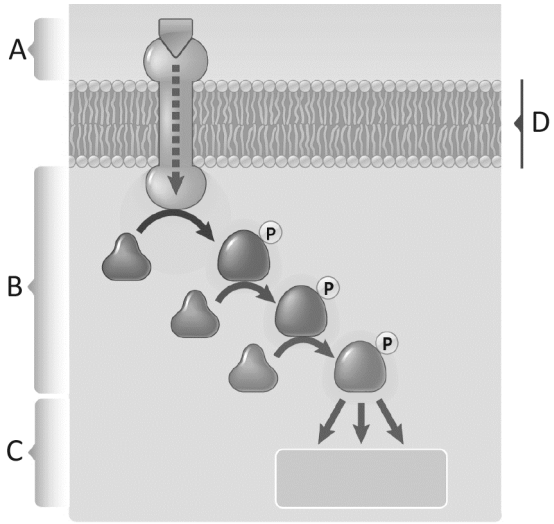
A. C3 plants initially fix CO_2 using PEP carboxylase and phosphoenolpyruvate (PEP).
B. C4 and CAM plants do not generate glyceraldehyde-3-phosphate (G3P) via the Calvin Cycle.
C. **C4 plants carry out the initial CO_2 fixation in mesophyll cells, but the Calvin Cycle occurs in other, specialized cells (bundle sheath cells)**.
D. In CAM plants, the oxygenase function of Rubisco is used to fix CO_2 into organic molecules.

20. The water necessary for photosynthesis

A. keeps CO_2 concentrations high in leaf tissue.
B. is directly involved in the synthesis of carbohydrate (sugars).
C. **provides electrons to replace lost electrons in photosystem II**.
D. provides the necessary H^+ ions needed to synthesize glyceraldehyde-3-phosphate(G3P).
E. provides the terminal electron acceptor (oxygen) for the electron transport chain.

21. The folic acid (or folate) pathway in humans is an example of _____

A. competitive enzyme inhibition.
B. catabolism.
C. **anabolism**.



22. In the above figure, which label indicates the **reception** stage?

(On the scantron, answer **A**, B, C or D as shown in figure.)

23. Oncogenes result from

A. cell-contact inhibition.
B. programmed cell death.
C. mutations in genes encoding proteins that normally inhibit progression of a cell through the cell cycle.
D. **mutations that cause the overexpression of genes encoding proteins that normally stimulate the cell cycle**.

24. Which of the following is **NOT** an example of the results of mitosis?

A. An embryo formed from a zygote.
B. Cells produced by asexual reproduction of a single-celled amoeba.
C. The healing of a wound.
D. The mature plant arising from a root cutting (removed from another mature plant).
E. **A zygote produced by the union of gametes from two parents**.
F. All of the above are examples of the results of mitosis.

25. Progression through the cell cycle is regulated by oscillations (changes in levels) in concentration of which type of molecule?

A. centrioles
B. p53
C. **cyclins**.
D. cyclin-dependent kinases (CDKs)

26. During DNA replication, DNA ligase is most active on the lagging strand. Why?

A. The lagging strand requires DNA ligase to link RNA primers to the Okazaki fragments.
B. **The lagging strands contain more short DNA segments than the leading strand, and these short segments are joined together by DNA ligase**.
C. The lagging strand is synthesized more slowly, and DNA ligase prevents the different lengths of DNA strands from becoming tangled.
D. The lagging strand synthesizes DNA in the 3' → 5' direction, which requires a special polymerase that works in this direction.

27. Once replication has finished, Strand C in the figure above will have the same sequence/order of nucleotides as which strand(s)?

A. **Strand A**.
B. Strand B.
C. Strand D.
D. Strands B and D.
E. Strands A and B.

28. For a particular cell, the number of _____ is higher at the end of S phase than at the start.

A. chromosomes
B. **chromatids**.
C. nuclei
D. Both A and B.

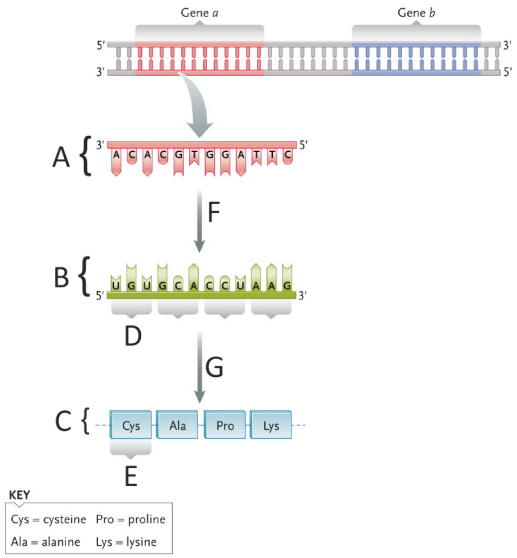
The number of chromosomes remains the same, but each chromosome will have 2 chromatids after DNA replication (before S phase, only 1 chromatid per chromosome).

29. Which of the following is true of mitotic anaphase?

A. **Sister chromatids separate, and chromosome number of the cell is briefly doubled**.
B. The nuclear membrane re-forms.
C. Motor proteins and microtubles help chromosomes line up at the centre of the cell.
D. The spindle apparatus assembles, microtubules polymerize into spindle fibers.

30. Which of the following statements is true of bacterial binary fission and mitosis?

A. **Both produce two daughter cells that are genetically identical to one another and the parent cell**.
B. Both yield four daughter cells that exhibit genetic variation (among daughter cells, and between daughter cells and parent cell).
C. Both reduce the ploidy in daughter cells to half of what was present in the parent cell.
D. None of the above statements is true of bacterial cell division and mitosis.
E. Both involve nuclear division stages, followed by cytokinesis.



31. In the above figure, which letter indicates **transcription**?

(On scantron, indicate appropriate letter [A,B,C,D,E, **F** or G] from labelled regions of figure.)

32. In the above figure, which letter indicates **a codon**?

(On scantron, indicate appropriate letter [A,B,C,**D**,E, F or G] from labelled regions of figure.)

33. In bacteria, a repressor protein blocks the synthesis of mRNA that encodes enzymes for digestion of lactose when no lactose sugar is available. When lactose is present, the sugar binds to the repressor, causing it to detach from the DNA strand, allowing RNA polymerase to bind to the promoter. This an example of

    A. **transcriptional regulation**.
    B. translational regulation.
    C. posttranscriptional regulation.
    D. posttranslational regulation.

34. After eukaryotic mRNA is transcribed, all of the following will occur, **EXCEPT**:

    A. Transport to the cytosol.
    B. **Binding of RNA polymerase to the promoter**.
    C. Capping of the 5' end.
    D. Addition of a polyA tail to the 3' end.
    E. Splicing out the introns.

35. Genetic variation can result from of all of the following processes, **EXCEPT**:

    A. Independent assortment of alleles in Meiosis II.
    B. Random segregation of chromosomes in Meiosis I.
    C. **DNA reorganization during interkinesis**.
    D. Recombination between non-sister chromatids.
    E. Random fertilization of gametes in sexual reproduction.

36. Which of the following human cells contains a gene that specifies eye colour?

    A. Gametes (sperm and egg).
    B. Cells in the eye.
    C. Cells in the heart.
    D. **All of the above (in A through C)**.
    E. Only two of the above (in A through C).

37. Most animals have somatic (body) cells that are _____, and gametes that are _____ .

    A. haploid; diploid.
    B. **diploid; haploid**.
    C. diploid; polyploid.
    D. haploid; polyploid.

38. Frameshift mutations result from

    A. **addition or deletion of one or more base pairs**.
    B. substitution of nucleotides.
    C. substitution of codons.
    D. substitution of amino acids.
    E. all of the above.

39. During the process of spermatogenesis (sperm production), a nondisjunction event that occurs during meiosis II would be _____ if it occurred in meiosis I, because _____of the meiotic products will be aneuploid from nondisjunction in meiosis II.

A. the same as; half.
B. the same as; all.
C. **better than; half**.
D. worse than; all.

40. If we represent/draw chromosomes as condensed throughout the cell cycle (for clarity – not necessarily reflecting actual state), which notation below best describes the cell in the figure shown?

Cell is diploid (we see 2 of each chromosome), with total of 8 chromosomes so the best descriptor is 2n=8.

A. n=2
B. n=4
C. n=8
D. 2n=4
E. 2n=8.
F. 4n=8

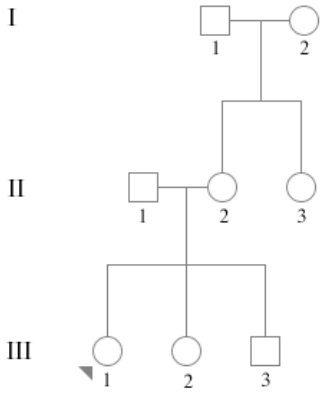
41. Which of the following genotypes is homozygous?

A. *aaBb*.
B. *Aabb*.
C. *AaBB*.
D. *AaBb*.
E. ***aaBB***.

42. If a particular gene has one allele that is completely dominant (*A*) and another that is recessive (*a*), which of the following is true?

A. Individuals who are *aa* will exhibit less fitness than *AA* or *Aa* individuals.
B. The *a* allele will be less common in the general population compared to the *A* allele.
C. ***AA* individuals and *Aa* individuals will have the same phenotype for this character**.
D. The *A* allele prevents the expression (at the transcriptional level) of the *a* allele in *Aa* individuals.
E. Two of the above (in A through D) are true.

43. Consider the following pedigree showing 3 generations of a family:



I.1 is I^AI^B I.2 is I^Ai
II.1 is *ii*, II.2 is I^Ai, II.3 could be I^AI^B, I^Ai, or I^Bi.
III.1 is *ii*, III.2 and III.3 must be I^Ai or *ii*.

Blood types are known for the following individuals:
I.1: type AB.
I.2, II.2: type A.
II.1, III.1: type O.

The ABO blood system includes 3 alleles (I^A, I^B, and *i*). Considering the blood types and pedigree, all of the following are true of genotypes of the above family members **WITH THE EXCEPTION OF**:

A. **II.3 must be I^Ai, I^Bi, or *ii***.
B. II.2 must be I^Ai.
C. Both III.2 and III.3 must be I^Ai or *ii.*
D. **I.2 must be I^Ai or I^AI^A**.

44. A man and woman are both of normal pigmentation, but both have one parent who is albino (without melanin pigmentation). Albinism is an autosomal recessive trait. What is the probability that their first child will be albino?

A. 1
B. 0
C. **1/4**.
D. 1/8
E. 1/2

45. You are studying trait inheritance in the sweet pea for two genes — the gene for flower colour (*P*, purple, and *p*, red) and the gene affecting the shape of pollen grains (*L*, long, and *l*, round). You have a heterozygote for both genes (purple, long: *PpLl*), and cross this plant with a red, round (*ppll*) plant. The progeny from this cross:

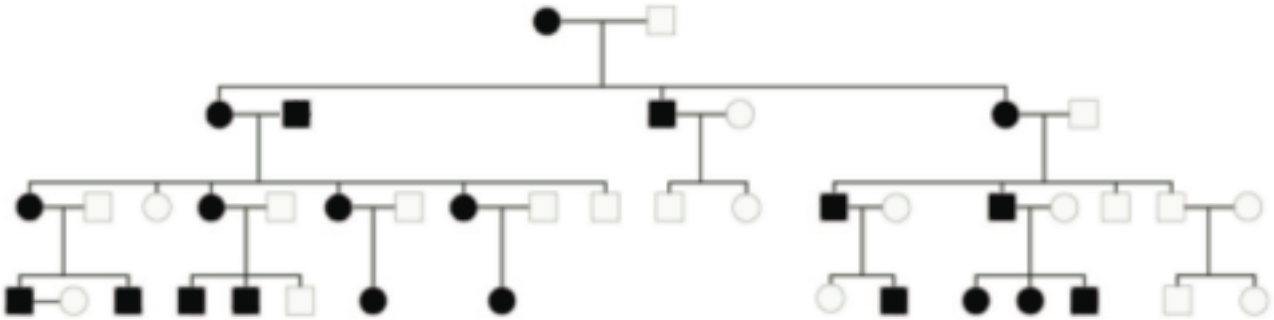
10 purple, long
12 red, round
91 purple, round
87 red, long

Using this information, which of the following is true regarding the flower colour and pollen grain genes/alleles in the heterozygote used in the cross?

A. Recombination does not occur between these genes.
B. They are assorting independently.
C. They are linked; the parental allele combinations are: (1) *P* and *L*, and (2) *p* and *l*.
D. **They are linked; the parental allele combinations are (1) *P* and *l*, and (2) *p* and *L***.

46. In cats, black fur colour is caused by a sex-linked allele; the other allele at this locus causes orange colour. The heterozygote is tortoiseshell. What kinds of offspring would you expect from the cross of a black female and an orange male?

A. Orange females; orange males.
B. **Tortoiseshell females; black males**.
C. Orange females; black males.
D. Tortoiseshell females; tortoiseshell males.
E. Black females; orange males.



47. Examine the pedigree in the figure above. Of the following inheritance patterns, which is most likely responsible for the "affected" condition?

    A. **autosomal dominant**.
    B. autosomal recessive
    C. X-linked recessive
    D. X-linked dominant

Note that condition occurs in each generation; 2 affected parents had non-affected children; male parents with condition have affected sons.

48. A testable statement or model (in its early stages) that explains a biological phenomenon is referred to as a/an:

    A. theory.
    B. variable.
    C. assumption.
    D. control.
    E. **hypothesis**.

49. When light hits a pigment, the energy from a photon is _____ an electron of the pigment molecule.

    A. **transferred to**.
    B. transmitted through
    C. reflected from
    D. Both B and C.

50. Autotrophs obtain carbon from

    A. organic carbohydrate molecules.
    B. **CO_2**.
    C. any molecule.
    D. light.

51. Evolution occurs at which level of organization?

A. organism
B. organ
C. molecule
D. **population**.
E. all of the above.

52. The "information system" of the cell involves RNA in the role(s) of:

i. stable, long-term information storage.
ii. a short-lived copy of genetic information.
iii. machinery producing proteins by linking individual amino acids, based on genetic sequence information.

A. i only.
B. ii only.
C. i, ii, and iii.
D. **ii and iii only**.
E. None of the above.

53. Microtubules and microfilaments have different functions mainly because of

A. fluctuating levels of ATP in cells.
B. chemical composition (different proteins in certain types of microtubules, microfilaments).
C. location (e.g., within the nucleus, the cytoplasm or cell surface).
D. **association with other proteins**.

Question only counted as bonus – no penalty for incorrect answer.

54. Which of the following is true regarding both oxygenic and non-oxygenic photosynthesis?

A. Organisms carrying out these reactions appeared at the same time in Earth's history.
B. H_2O is required.
C. **CO_2 is fixed**.
D. O_2 is released.

55. Which of the following best represents the flow of proteins in the cell (from synthesis to extracellular release)?

A. Lysosomes→ Golgi complex →endocytic vesicles.
B. Endocytic vesicles→ lysosomes → endoplasmic reticulum→ secretory vesicles.
C. **Endoplasmic reticulum → transport vesicles → Golgi complex →secretory vesicles**.
D. Golgi complex → secretory vesicles→ endoplasmic reticulum→ transport vesicles.
E. Endoplasmic reticulum → secretory vesicles → Golgi complex → lysosomes.

56. Which of the following is true regarding the DNA of both Bacteria and Archaea?

A. Some bacteria and archaeans have DNA in the form of pili that extend from the surface of the cell.
B. **Some bacteria and archaeans contain DNA in the form of small, circular plasmids**.
C. Bacteria and archaeans do not have chromosomes.
D. DNA is present in a nucleus, which is much smaller than the nucleus of a eukaryotic cell.

57. Each of the following are organelles that contain DNA, ***EXCEPT***

A. chloroplasts
B. nuclei
C. mitochondria
D. **ribosomes**.
E. All of the above contain DNA.

58. If the volume of a cell increases, its surface area will

A. remain the same (i.e., neither increase nor decrease).
B. increase proportionately.
C. increase to a greater degree than the volume.
D. **increase to a lesser degree than the volume**.
E. decrease.

END OF TEST – Enjoy the holiday break!