

Biology 1441 FINAL EXAM: 5 May 2008 -- Dr. Chippindale

Instructions: Read each question carefully. Mark each answer on your Scantron card AND circle the correct answer on your test paper. If there is any issue about your Scantron, I will use the circled answers on your test paper to determine your grade. Only one answer is correct for each question. There are questions on both sides of the pages. If anything is unclear, ASK.

1) Which of the following statements is FALSE?

- a) Generally, the reactivity of an element increases with the number of electrons in its valence shell, and atoms with eight valence shell electrons are the most reactive.
- b) The monomers of nucleic acids are amino acids.
- c) When two atoms with equal electronegativity share a pair of electrons, they are joined by an ionic covalent bond.
- d) Uracil is present in DNA wherever adenine would be present in RNA.
- e) A hydrogen atom consists of a single electron orbiting a single proton.

2) When a reversible reaction has reached chemical equilibrium,

- a) the reaction is finished.
- b) the reaction is halfway to completion.
- c) all reactants have been converted to products.
- d) net change in free energy of products and reactants is zero, but bonds are still being made and broken.
- e) free energy of reactants has been maximized, and bonds are still being made and broken.

3) Water:

- a) is the most widespread nonpolar solvent on Earth.
- b) has a high specific heat and a low heat of vaporization.
- c) has a high degree of surface tension and is less dense when frozen than when liquid.
- d) is considered the most important organic molecule for life on Earth.
- e) exhibits molecular cohesion and has a low specific heat.

4) The pH scale is constructed such that:

- a) The more basic a solution is, the lower the concentration of hydroxide ions.
- b) The more acidic a solution is, the lower the concentration of hydrogen ions.
- c) Each number in the scale represents a doubling or halving of hydrogen ion concentration
- d) The more basic a solution is, the less ionic bonding occurs.
- e) As pH values increase, a solution becomes increasingly basic.

5) Which of the following statements is TRUE?

- a) Enzymes facilitate chemical reactions without being used up in the process.
- b) Enzymes cause reactions that otherwise could not occur to take place.
- c) Enzymes raise the activation energy of reactions.
- d) Enzymes are synthesized in the nuclei of eukaryotic cells.
- e) Enzymes generally consist of a combination of mRNA and proteins.

6) Which of the following is largest in weight?

- a) typical plant cell
- b) typical bacterium
- c) monosaccharide
- d) typical eukaryotic chromosome
- e) mitochondrion

7) Channels that allow the cytoplasm of one animal cell to contact that of another are called:

- a) gap junctions.
- b) plasmodesmata.
- c) tight junctions.
- d) cristae.
- e) microfilaments.

8) Which of the following elements would you NOT find in a DNA molecule?

- a) phosphorus
- b) sulfur
- c) oxygen
- d) hydrogen
- e) nitrogen

9) A cell pumps a substance out against its electrochemical gradient. This represents:

- a) chemiosmosis.
- b) hydrolysis.
- c) facilitated diffusion.
- d) reverse osmosis
- e) active transport.

10) If a female human carries a genetic disorder that involves an enzyme encoded by her mt DNA, then her sons:

- a) will only have the disorder if it is caused by a recessive allele.
- b) will have a 25% chance of having the disorder too.
- c) cannot inherit the disorder.
- d) will have the disorder.
- e) will have a 50% chance of having the disorder too.

11) The first law of thermodynamics states that:

- a) The entropy of the universe is constantly decreasing.
- b) Energy can be created but never destroyed.
- c) Energy can be transformed or transferred, but never created or destroyed.
- d) Energy can be created from entropy, but the reverse is not possible.
- e) There is a continual increase in the entropy of the universe.

12) Which of the following statements is TRUE?

- a) A saturated fat contains the maximum possible number of carbon-carbon double bonds in its tail.
- b) Steroids are lipids.
- c) The major storage polysaccharide of plants is cellulose.
- d) Condensation reactions are a key part of breakdown of macromolecules to their subunits.
- e) The quaternary structure of a protein determines its structure at all other levels.

13) If a plant cell were placed in a hypotonic solution, the likeliest result would be:

- a) Active transport would prevent loss of water from the cell.
- b) Water would rush out and the cell would shrivel up.
- c) Nothing would happen, because movement of water across the cell wall is not possible.
- d) Facilitated transport would prevent gain of water by the cell.
- e) Water would rush in until further expansion of the cell membrane was limited by the cell wall.

14) Which of the following statements is TRUE?

- a) Cell membranes consist of a single layer of phospholipids in which a variety of proteins and other molecules are imbedded.
- b) Cell membranes consist of a double layer of phospholipids in which a variety of proteins and other molecules are imbedded.
- c) Cell membranes consist primarily of a double layer of cholesterol molecules, with imbedded proteins and other molecules.
- d) Cell membranes consist primarily of a single layer of cholesterol molecules, with imbedded proteins and other molecules.
- e) Cell membranes are extremely rigid structures in which the molecules are firmly held in place.

15) Which of the following structures synthesizes or modifies molecules, then "tags" them for distribution to other parts of the cell or for secretion? a) ribosome b) peroxisome c) vacuole d) Golgi apparatus

- e) vesicle

16) Ribosomes are present: a) in eukaryotic cells only. b) in prokaryotic cells only. c) in eukaryotic and prokaryotic cells. d) in mitochondria but not chloroplasts. e) only in animals.

17) Which of the following statements is TRUE?

- a) In cellular respiration, FADH_2 acts as a reducing agent.
- b) In cellular respiration, FADH_2 is a key part of the electron transport chain.
- c) In cellular respiration, NADPH acts as an oxidizing agent.
- d) In cellular respiration, ATP acts as an oxidizing agent.
- e) In cellular respiration, ATP acts as a reducing agent.

18) Which of the following statements is TRUE? a) Tyrosine kinase is the only signal molecule that can actually enter a cell. b) Calcium ions often act as second messengers in cells.

- c) The process by which information carried by a molecule outside the cell is converted to a response inside the cell is called translation.
- d) Sodium ions are the most common signal molecules that stimulate G-protein-linked receptors.
- e) The process by which information carried by a molecule outside the cell is converted to a response inside the cell is called transcription.

19) Glycolysis occurs in the: a) stroma. b) stoma. c) inner mitochondrial membrane. d) outer mitochondrial membrane. e) cytosol.

20) Which of the following statements is TRUE?

- a) Fermentation yields a net total of many more ATP molecules per glucose molecule than cellular respiration.
- b) While cellular respiration is a much more efficient producer of ATP than fermentation, fermentation requires oxygen whereas cellular respiration does not.
- c) Energy for regeneration of ATP by the electron transport chain involves establishment of a high concentration of protons in the mitochondrial matrix.
- d) In the Krebs cycle, pyruvate is regenerated through a series of enzyme-catalyzed steps.
- e) Glycolysis can occur with or without the presence of oxygen.

21) Production of most ATP in cellular respiration occurs via:

- a) oxidative phosphorylation in the electron transport chain.
- b) oxidative phosphorylation during the Krebs cycle.
- c) substrate-level phosphorylation during glycolysis.
- d) substrate-level phosphorylation during the Krebs cycle.
- e) substrate-level phosphorylation in the electron transport chain.

22) Which of the following statements is TRUE?

- a) Plants use chloroplasts to generate most ATP for cellular metabolism, and animals use mitochondria to do this.
- b) Animals use mitochondria to fix atmospheric carbon, and plants use chloroplasts to do this.
- c) Mitochondrial processes generate carbon dioxide in both animals and plants.
- d) Chloroplasts are responsible for generation of oxygen in plants, and mitochondria are responsible for generation of oxygen in animals.
- e) The oxygen released by photosynthesis is derived from the splitting of carbon dioxide.

23) Couple A has three sons, and couple B has one son and two daughters. Each couple decides to have another child. Which of the following statements is most likely to be correct?

- a) Couple A has a 75% chance of having a daughter.
- b) Couple A has a 50% chance of having a daughter.
- c) Couple B has 75% chance of having a son.
- d) Couple B has a 33% chance of having a daughter.
- e) Couple A has a 75% chance of having a daughter AND couple B has a 33% chance of having a daughter.

24) If the sequence of a tRNA anticodon is GCA, the sequence of the corresponding part of the mRNA will be:

- a) ACG b) UCG c) CGU d) CGT e) GCU

25) Mitochondria and chloroplasts:

- a) are both part of the endomembrane system of eukaryotic cells.
- b) are descended from bacteria that colonized ancestors of modern eukaryotic cells.
- c) are present in both prokaryotic and eukaryotic cells.
- d) both lack membranes.
- e) have distinct, well-defined nuclei.

26) Match the correctly ordered list of time periods below with the following list of events: (i) double helix structure of DNA discovered (ii) Mendel determines rules of inheritance (iii) genetic code deciphered (iv) chromosomal theory of inheritance (v) first studies of meiosis

- a) (i) 1960s (ii) 1890s (iii) 1950s (iv) beginning of 20th Century (v) 1860s
- b) (i) beginning of 20th Century (ii) 1960s (iii) 1950s (iv) 1890s (v) 1860s
- c) (i) 1950s (ii) 1860s (iii) 1960s (iv) beginning of 20th Century (v) 1890s
- d) (i) 1950s (ii) 1860s (iii) 1960s (iv) 1890s (v) beginning of 20th Century
- e) (i) 1960s (ii) 1860s (iii) 1950s (iv) beginning of 20th Century (v) 1890s

27) ATP in photosynthesis is generated as a result of:

- a) cyclic and noncyclic electron flow
- b) cyclic electron flow only
- c) catalyzation by Rubisco
- d) noncyclic carbon fixation only
- e) catalyization by ubiquinone

28) Blood in a normal, healthy human generally has a pH that is:

- a) slightly basic
- b) slightly acidic
- c) exactly neutral
- d) very basic
- e) very acidic

29) Which of the following statements is TRUE?

- a) The Calvin cycle of photosynthesis can only occur in the dark, but chemiosmosis in the chloroplast can occur in either light or dark.
- b) The Calvin cycle of photosynthesis takes place in the thylakoids when light is present, and in the stroma during the dark.
- c) Generation of ATP and NADPH to power chemiosmotic processes in the thylakoid requires light-induced Calvin cycle activity.
- d) The Calvin cycle occurs in the stroma during light or dark and requires input of ATP and NADPH.
- e) The light reactions of photosynthesis occur in the stroma, and can actually take place in either light or dark conditions.

30) An atom of zinc has 30 protons, 35 neutrons, and 30 electrons. This means that its atomic number is:

- a) 30
- b) 35
- c) 60
- d) 65
- e) 95

31) Which of the following correctly describes the order of events in mitosis from beginning to end?

- a) G1, S, G2, prophase, metaphase, telophase
- b) prophase, prometaphase, metaphase, anaphase, telophase
- c) prophase, prometaphase, metaphase, telophase, anaphase
- d) telophase, prophase, prometaphase, metaphase, anaphase
- e) anaphase, prophase, prometaphase, metaphase, telophase

32) During mitosis, spindle fibers attach to structures called _____ at the centromeres of the chromosomes.

- a) centrosomes
- b) centrioles
- c) kinetochores
- d) microtubules
- e) chromatins

33) Humans are:

- a) diploid organisms in which the female is the heterogametic sex.
- b) haploid organisms in which the male is the heterogametic sex.

- c) diploid organisms in which the male is the heterogametic sex.
- d) haploid organisms in which the female is the heterogametic sex.
- e) tetraploid organisms in which the male is the heterogametic sex.

34) In meiosis, you would find two cells, each containing one chromosome of each type consisting of joined sister chromatids, lined up across the center of the cell, at:

- a) metaphase I. b) metaphase II. c) prophase I. d) prophase II. e) telophase II.

35) Which of the following statements is TRUE?

- a) Mitosis results in four daughter cells that are genetically identical, whereas meiosis results in two daughter cells that are haploid.
- b) Mitosis results in four haploid daughter cells, whereas meiosis results in two diploid daughter cells.
- c) Meiosis results in four diploid daughter cells, whereas mitosis results in two diploid daughter cells.
- d) Mitosis results in two daughter cells that are genetically identical, and meiosis results in four daughter cells that are genetically identical.
- e) Meiosis results in four genetically different haploid daughter cells whereas mitosis results in two genetically identical daughter cells.

36) You examine the karyotype of a chromosomally normal human male. You pick out two specific chromosomes: the Y chromosome and a particular copy of autosome 9. What are the chances that this individual received this particular Y chromosome from his father AND this particular autosome 9 from his mother? a) 0% b) 25% c) 50% d) 75% e) 100%

37) If an allele is dominant, this means that:

- a) It is the most common allele in a population.
- b) It is the best allele in a population.
- c) Only homozygotes for this allele will show the phenotype associated with the allele.
- d) Both homozygotes and heterozygotes for this allele will show the phenotype associated with the allele.
- e) Blending inheritance is occurring.

38) Suppose that, in a particular breed of chicken, feathers on the beak is a sex-linked recessive trait. If you cross hens (females) without feathered beaks to roosters (males) with feathered beaks, which result would you expect for the F1? (Hint: Remember what you know about sex determination in birds).

- a) 75% of females have nonfeathered beaks and 25% of males have feathered beaks.
- b) 100% of females have nonfeathered beaks and 50% of males have feathered beaks.
- c) 100% of males have nonfeathered beaks and 100% of females have feathered beaks.
- d) 50% of males have nonfeathered beaks and 50% of females have feathered beaks.
- e) 75% of males have nonfeathered beaks and 25% of females have feathered beaks.

39) Phosphofructokinase (PFK) is a critical rate-controlling enzyme in which of the following biochemical pathways?

- a) Calvin cycle b) Electron transport chain c) Polypeptide synthesis d) Glycolysis e) Signal transduction

40) The term “epistasis” describes:

- a) Multiple genes determining a phenotypic trait.
- b) Multiple phenotypic effects of a single gene.
- c) Rate of transcription of a gene responsible for a phenotypic trait.
- d) The range of possible phenotypes for a given genotype.
- e) Products of one gene affecting the phenotypic expression of another.

41) Of the following colors (wavelengths) of light, which typically contributes most to photosynthesis?
a) yellow b) orange c) green d) infrared e) blue

42) You discover a mutant eye color allele in *Drosophila melanogaster* that is recessive and causes purple eyes instead of the dominant wild-type eye color allele, red. You figure out that this is due to one gene on chromosome 3 (an autosome). You perform a cross in which the female parent is homozygous for the wild-type red allele and the male parent is homozygous for the purple allele. Then you breed the F1 offspring to each other and score the phenotypes of 1000 F2 offspring. Which of the following results is most likely?

- a) 762 have purple eyes and 238 have red eyes.
- b) 523 have red eyes and 476 have purple eyes.
- c) 741 have red eyes and 259 have purple eyes.
- d) 340 have red eyes, 325 have purple eyes, and 335 have one red and one purple eye.
- e) All have eyes that are intermediate in color between red and purple.

43) Where would you find Okazaki fragments?

- a) Associated with the lagging strand during DNA replication.
- b) Associated with the leading strand during DNA replication.
- c) Associated with the template strand during transcription.
- d) Associated with mRNA during processing.
- e) Associated with mRNA during translation.

44) Morgan and colleagues performed the following fruitfly cross: flies that were heterozygous at two loci for the wild type and the recessive black body and vestigial wings alleles, mated with flies of the opposite sex that were homozygous for these two recessive alleles. The results, which led them to realize that these genes were chromosomally linked but subject to exchange due to crossing over, were that:

- a) all F1 offspring had the wild-type phenotype for both characters.
- b) all F1 offspring had the mutant phenotype for both characters.
- c) half the F1 offspring had the wild-type phenotype for both characters and half had the mutant phenotype for both characters.
- d) the great majority of F1 offspring had recombinant phenotypes.
- e) the great majority of F1 offspring had parental phenotypes.

45) Which of the following is in the correct order, from least to most inclusive (i.e., smallest to largest unit)?

- a) nucleotide/ codon/ gene/ chromosome/ genome
- b) codon/ nucleotide/ gene/ genome/ chromosome
- c) nucleotide/ gene/ codon/ chromosome/ genome
- d) gene/ genome/ codon/ chromosome/ nucleotide
- e) codon/ genome/ gene/ nucleotide/ chromosome

46) If a mutation occurred that caused insertion of an extra nucleotide near the beginning of a protein-coding DNA sequence, the likeliest result would be:

- a) improvement in the action of the protein due to the increased number of nucleotides
- b) improvement in the action of the protein due to the increased number of amino acids
- c) decrease in efficiency of the protein due to the increased number of nucleotides
- d) decrease in efficiency of the protein due to the reduced number of amino acids
- e) production of a protein that has lost its function

47) The start codon in the genetic code also codes for the amino acid:
a) phenylalanine. b) methionine c) valine d) glycine e) glutamine

48) In feedback inhibition of an enzyme:

- a) An enzyme in a metabolic pathway binds to an enzyme earlier in the pathway, blocking its action.
- b) The reactants in a biochemical pathway block the activity of an enzyme later in the pathway.
- c) The product of a reaction in a biochemical pathway blocks activity of an enzyme earlier in the pathway.
- d) A substance introduced to a cell competes with the usual substrate of an enzyme in a biochemical pathway, blocking the enzyme's activity.
- e) A substance introduced to a cell binds to the active site of an enzyme in a biochemical pathway, blocking the enzyme's activity.

49) Watson and Crick found that:

- a) In DNA of any given species, A content was equal to that of T, and content of G was equal to that of C.
- b) Bacteria of one phenotype could be transformed to another phenotype by exposure to killed cells with the other phenotype.
- c) The three dimensional structure of DNA consists of an alpha helix with the bases of nucleotides on each strand held together by hydrogen bonds.
- d) DNA replication is semiconservative.
- e) Amino acid sequences of proteins are determined by a triplet base code in the DNA.

50) Which of the following correctly describes the order of events in the elongation stage of translation?

- a) tRNA with attached amino acid enters A site/polypeptide attached to tRNA at P site transferred to tRNA at A site/ tRNA at P site released via E site, tRNA at A site moves to P site
- b) tRNA with attached amino acid enters P site/polypeptide attached to tRNA at A site transferred to tRNA at P site/ tRNA at A site released via E site, tRNA at P site moves to A site
- c) tRNA with attached amino acid enters A site/polypeptide attached to tRNA at P site transferred to small ribosomal subunit/ tRNA at P site released via E site, tRNA at A site moves to P site
- d) tRNA with attached amino acid enters P site/polypeptide attached to tRNA at A site transferred to large ribosomal subunit/ tRNA at A site released via E site, tRNA at P site moves to A site
- e) mRNA binds small ribosomal subunit and initiator tRNA/large ribosomal subunit attaches/initiation tRNA at P site

Version 3