

MAKEUP FINAL

For the multiple choice questions, there is *one* and *only one* best answer. READ THE OPTIONS CAREFULLY: multiple choice questions are formatted to reduce paper use and it can possibly be more troubling to comprehend options properly.

1. Which of these is made up of the protein actin?
(a) microtubules (b) microfilaments (c) intermediate filaments
(d) coated pits (e) none of the above
2. When splicing of pre-messenger RNA is done, this will be retained and become part of the messenger RNA (mRNA)?
(a) promoter (b) histone (c) poly(A) tail on 3' end (d) exon (e) intron
3. Which of these is TRUE about a function of the outer membrane of mitochondria?
(a) it contains all the redox components in the electron transport system
(b) protons (H^+) are move across it to build up a gradient to make
(c) enzymes like catalase and superoxide dismutase (SOD) are contained by it to reduce harmful oxygen species
(d) invaginations of this membrane increase the surface area to permit large amounts of ATP production
(e) it is a highly porous membrane that encloses the organelle
4. Very positively charged histone proteins use what type of chemical bond to help coil very negatively charged DNA?
(a) ionic bond (b) promoter bond (c) hydrogen bond (d) covalent bond (e) intron bond
5. A lysosome fused with a phagocytic vesicle. Which of these is FALSE?
(a) the lysosome contain proteins and other molecules that have digestive properties or chemical reactions that break down what is in the phagocytic vesicle
(b) the resulting vesicle has membrane protein transporters that are proton (H^+) ATPases and will move H^+ from the cytosol into the vesicle
(c) the pH within the vesicle will decrease
(d) both (a) and (b)
(e) none the above: all of the above are true
6. This kind of membrane protein is a classical example of one where a hormone (ligand) crosses through the membrane easily, binds to a receptor inside the cell, and the complex binds to DNA and starts gene transcription
(a) receptor tyrosine kinases (b) G protein-coupled receptors (c) steroid hormone receptors
(d) sodium (Na)/glucose transporter (e) ribosome-activation factor
7. This cell junction type controls paracellular transport: that is, it seals layers of cells against substances and things moving *between* cells rather than through them?
(a) adherens junction (b) desmosome (c) gap junction (d) nuclear pore (e) tight junction
8. The onset of the condensed chromosomes visibly moving apart from each other from the spindle equator is what phase of mitosis?
(a) prophase (b) prometaphase (c) metaphase (d) anaphase (e) telophase

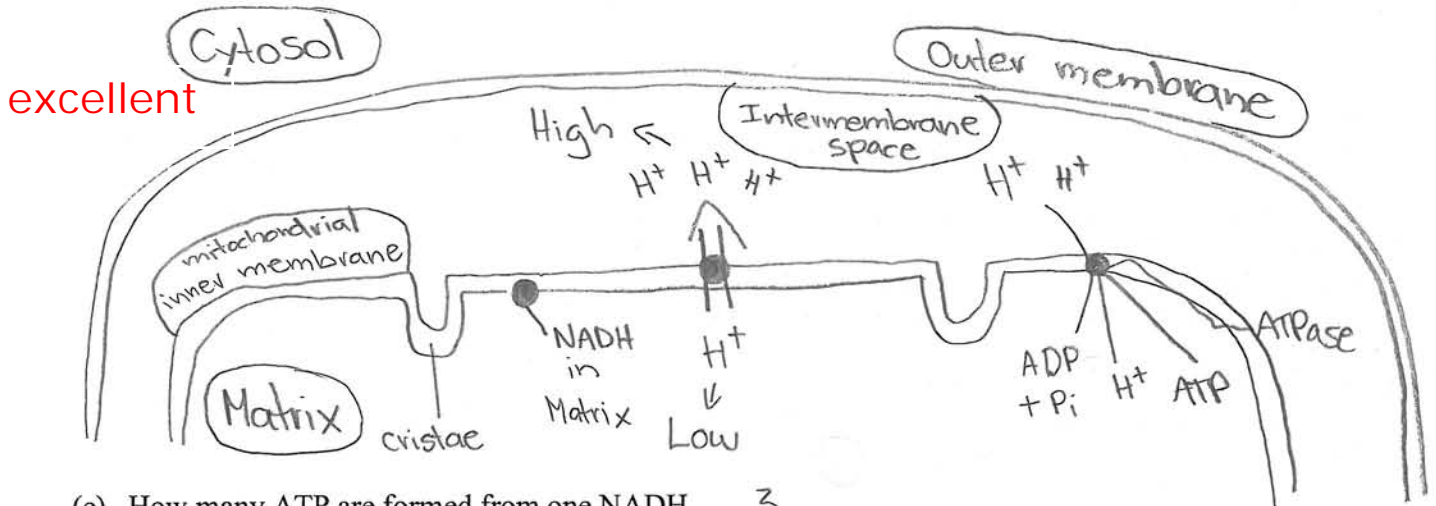
9. What is a term for the process when tRNA with an amino acid enters the A site of the ribosome, with its anticodon matched to the mRNA codon?
 (a) transcription (b) replication (c) decoding (d) translocation (e) transpeptidation
10. These are required to bring the RNA polymerase to the DNA where transcription starts:
 (a) transcription factors bind to promoter (b) histones forming nucleosomes
 (c) nuclear pores allowing exit of mRNA (d) exons being spliced out
11. Which of these describes oxidative phosphorylation?
 (a) ATP is produced by proton (H^+) gradients across mitochondrial inner membrane in electron transport
 (b) ATP is produced from a reaction in glycolysis or the TCA cycle
 (c) GTP is used to move ribosome during translation the distance of one codon or 3 nucleotides
 (d) ATP is used to move vesicles along a microtubule
 (e) ATP is produced during ribosome assembly in the nucleus
12. A genome has 35% G. Which of the following is FALSE about the genome?
 (a) it has 35% C (b) it has 15% A (c) the sum of the pyrimidine content is 50% (d) %T + %A = 50%
13. This structure for coiling DNA about twice around a core set of histones is called
 (a) solenoid (b) chromatid (c) chromosome (d) centriole (e) nucleosome
14. At the molecular level, this represents the many variations in the DNA sequences of a gene that show up as a variation in the trait corresponding to that gene
 (a) intron (b) exon (c) genome (d) allele (e) locus
15. Oligonucleotide A has a higher melting temperature (T_m) than oligonucleotide B, and both have the same length (same number of base pairs). Which of these is clearly understood to be FALSE?
 (a) %AT content of oligo A is lower than oligo B
 (b) %GC content of oligo B is lower than that of oligo A
 (c) the absorbance at 260 nm of oligo A will increase as temperature goes up
 (d) the melting of oligo B is denaturation: forming two single-strands of DNA from double-stranded DNA
16. Which of these is NOT a feature of the Golgi apparatus?
 (a) it has a *trans* face that receives vesicles from the endoplasmic reticulum (ER)
 (b) everything starts with vesicle fusion to the *cis* face of the Golgi
 (c) it has cisternae like the endoplasmic reticulum also has cisternae
 (d) lysosomes arise from vesicles formed in the Golgi
 (e) glycoproteins get modified within the Golgi
17. Which of these is a feature found in RNA?
 (a) 2'-deoxyribose (A) (b) thymine (T) (c) protein (d) ribose (e) lipid
18. The TCA cycle occurs where?
 (a) mitochondrial inner membrane (b) mitochondrial intermembrane space
 (c) mitochondrial matrix (d) cytosol (e) peroxisome
19. In the smooth endoplasmic reticulum (SER) these are enzymes that metabolize toxic substances:
 (a) cytochrome P450 enzymes (b) ribosomes (c) RNA polymerases (d) cisternae (e) lamins

20. A steroid hormone passes directly through the phospholipid bilayer membrane from a high concentration to a low concentration without needing transport protein. What is this an example of?
 (a) simple passive diffusion (b) exocytosis (c) receptor-mediated endocytosis
 (d) facilitated diffusion (e) coupled active transport
21. A vesicle comes off the *trans* face of the Golgi and makes its way to the plasma membrane fusing with it immediately and expelling its contents exocytically. Which of the terms below describes this process?
 (a) phagocytosis (b) simple passive diffusion (c) regulated secretion
 (d) constitutive secretion (e) lysosomal formation
22. This enzyme makes RNA required to start DNA replication:
 (a) RNA primase (b) ribosomal RNA (c) RNA ligase (d) RNA polymerase II (e) Na/K ATPase
23. Which of these RNA molecule types provides the actual code of amino acids for making a polypeptide during protein synthesis?
 (a) messenger RNA (mRNA) (b) ribosomal RNA (rRNA) (c) promoter RNA (pRNA)
 (d) transfer RNA (tRNA) (e) carrier RNA (cRNA)
24. How many possible codons are there in the "genetic code" (remember: there are 4 bases and 3 possible base positions making up a codon...do the math)?
 (a) 0 (b) 2 (c) 3 (d) 20 (e) 64
25. Which of these is TRUE with respect to the termination of eukaryotic translation?
 (a) it requires proteins called transcription factors to bind to the promoter
 (b) a poly(A) tail will be added to the 3' end of the messenger RNA
 (c) the ribosome A site must be positioned on a stop codon
 (d) exons will be spliced out of the RNA to make the final message
26. Which of these is FALSE with respect to the initiation of transcription?
 (a) DNA polymerase be used
 (b) RNA will be synthesized in the 5' → 3' direction
 (c) it requires transcription factors
 (d) it requires promoters
27. These are polymers of keratin that connect to desmosomes within cells subjected to mechanical stress
 (a) intermediate filaments (b) adherens junction (c) microfilaments
 (d) microtubules (e) peroxisomes
28. Pyruvate is metabolized by the pyruvate dehydrogenase enzyme to form a 2-carbon product. Which of these is a TRUE statement about that reaction?
 (a) CO₂ is a reactant (consumed in the reaction) (b) the 2-carbon product is acetyl-CoA
 (c) NADH is formed (d) the 2-carbon product is ethanol (e) glucose is a reactant
29. NADH is *formed* in which of these metabolic processes?
 (a) glycolysis (b) TCA cycle (c) electron transport (d) DNA replication (e) both (a) & (b) -1
30. A single FADH₂ molecule will produce how many ATP in the electron transport system?
 (a) 1 (b) 2 (c) 3 (d) 32 (e) 38
31. What is the term for the physical location on the chromosome where a gene is found?
 (a) allele (b) centromere (c) locus (d) genome (e) Golgi

32. Osmosis is the diffusion of what molecule or type of molecule?

- (a) carbon dioxide (CO_2) (b) water (H_2O) (c) amino acids (d) lipids (e) carbohydrates

33. (a) Draw a very simple diagram showing the relationship of the mitochondrial inner membrane, intermembrane space, outer membrane and matrix. (b) Show which side NADH is on when it interacts with the electron transport system in the membrane. (c) Show how protons move across one of the parts of the mitochondria above and where the high concentration side of H^+ is. (d) Show how ATP is formed.



(e) How many ATP are formed from one NADH 3

(f) How many H^+ are required to form one ATP molecule? 3

~~(g)~~ Oxidative phosphorylation produces ATP from a concentration difference of ions moving across a membrane from high concentration to low concentration coupled to a membrane protein. Name any membrane protein learned that does the opposite and utilizes ATP to move ions from low concentration to high concentration (against their gradient)?

Na⁺/K⁺ ATPase is one example -2

34. (a) Nucleotides have 3 parts to their structure: name them or draw their structure

- (i) Nitrogenous bases (A, G, T, C) (iii) Phosphate
(ii) Sugar (Ribose/Deoxyribose)

(b) The 5 nitrogenous bases that make up are members of TWO classes of structures that begin with the letter

"P." (i) What is the name of the one class that has a chemical structure with two rings fused to each other, one pentagonal and the other hexagonal? (ii) Also write the one-letter symbol or the name of one nitrogenous base that is a member of it.

(i) Purine

(ii) Adenine / Guanine

(c) (i) What is the name of the other class with a single hexagonal ring as its chemical structure?

(ii) Also write the one-letter symbol or the name of one nitrogenous base that is a member of it

(i) Pyrimidine

(ii) Thymine / Uracil / Cytosine

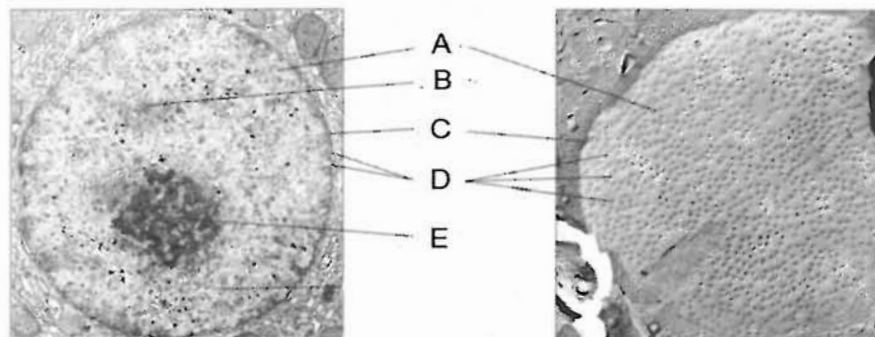
35. The double-stranded DNA helix has different conformations.

(a) What is the classic Watson-Crick conformation with the right-handed helical twist called?

(b) what is the form of DNA called that has a zig-zag left-handed twist and is transcriptionally inactive?

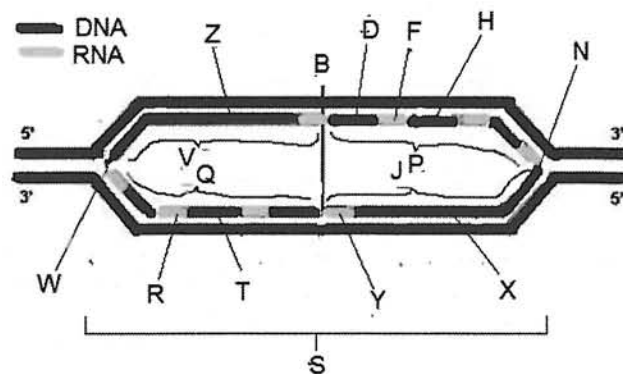
a) B-DNA

b) Z-DNA



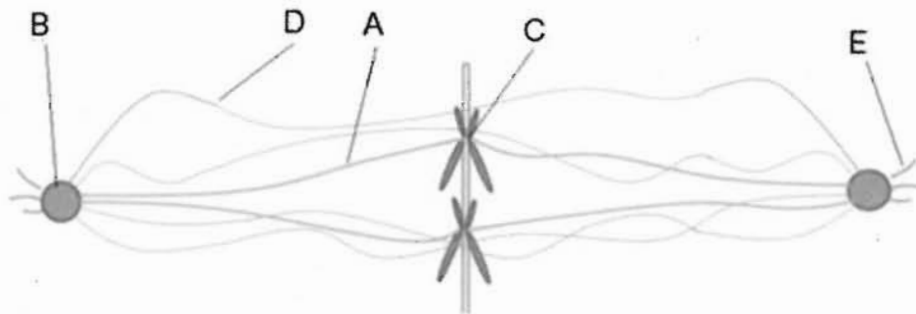
36. The figure above are two electron micrographs of a nucleus with fundamental parts labeled, and used in lecture. From the description below and using the labeled images above, write the NAME of the part of the nucleus. Item A is already labeled for you

- | | |
|----------------------------|--|
| A] <u>Nucleus</u> | the organelle of the cell that contains its genome and is enclosed in two membranes and protects that genome from being altered by biochemical reactions occurring elsewhere in the cell |
| B] <u>Chromatin</u> | this is the term given to the combination of DNA, RNA, and proteins that help to coil and manage the DNA making up genome (single 9-letter word) |
| C] <u>Nuclear Envelope</u> | refers to the structure made of two membranes, inner and outer, with a perinuclear space in between (two words, total 15 letters) |
| D] <u>Nuclear pores</u> | this is the term for a structure that has an annulus made up of an octameric protein through which all molecules like mRNA pass through to get in or out of nucleus (two words, total 12 letters, plural) |
| E] <u>Nucleolus</u> | this is a structural feature seen under the microscope where ribosomes are assembled from the proteins and ribosome RNA present in large amounts here, accounting for its special microscopic distinction from the nucleoplasm (9 letter word) |



37. Above is a figure relevant to the replication of DNA showing DNA and RNA strands. There may be several possibilities for answers below in the diagram above. You only need enter one answer.

- | | |
|---------------------------------|---------------------------------|
| (a) <u>B</u> replication origin | (b) <u>Z</u> newly made DNA |
| (c) <u>Q</u> lagging strand | (d) <u>W</u> replication fork |
| (e) <u>R</u> RNA primer | (f) <u>S</u> replication bubble |
| (g) <u>V</u> leading strand | |



38. The figure above is taken from the presentation on mitosis and specifically talks about the types of microtubules involved in mitosis

- A] chromosomal MT this is the name of the microtubule in mitosis that connects spindle pole to chromosome
- B] aster this term is used for spindle pole that radiates out microtubules during mitosis
- C] kinetochore this term is for structure that connects the centromere of the chromosome to the type of microtubule labeled A
- D] polar microtubule this is the name of the microtubule in mitosis that connects one spindle pole with the other that pushes the poles apart
- E] astral microtubule this is the name of the microtubule in mitosis that connects spindle pole to the plasma membrane so that the poles can be further pulled apart from each other during mitosis

F] These are two structures at right angles to each other and have a pinwheel array of 9 fused triplet formations of microtubules.

Centrioles

G] This structure is actually composed of the two structures described in item F, and forms a microtubule-organizing center located near the nucleus and is vital for mitosis, wherein it duplicates and then migrates to form the spindle poles in mitosis?

Centrosome

H] All microtubules are made up of these two proteins: what are the names of these proteins?

① Alpha-tubulin

② Beta-tubulin