PROVINCIAL EXAM PACKAGE

A. Cell Structures

1. B	16. C	31. D	46. C
2. D	17. C	32. D	47. C
3. B	18. B	33. D	48. C
4. B	19. A	34. D	49. A
5. A	20. C	35. C	50. A
6. C	21. D	36. B	51. C
7. D	22. C	37. B	52. B
8. see below	23. D	38. A	53. B
9. D	24. B	39. B	54. C
10. C	25. A	40. D	55. A
11. D	26. C	41. D	56. see below
12. D	27. D	42. B	57. see below
13. D	28. B	43. B	
14. C	29. D	44. C	
15. C	30. C	45. C	

8. **Chromosomes:** mitosis, meiosis, protein synthesis

   Mitochondria: cellular repiration

   Lysosomes: intracellular digestion

56. Cell A = microvilli to increase surface for tubular reabsorption

    = more mitochondria for active transport of substance such as glucose

    Cell B = more endoplasmic reticulum

    = Smooth ER – detoxifying blood (peroxisomes)

    = Rough ER – make plasma proteins from amino acids (more Golgi for same purpose)

57. **Vesicle**-storage & transport of cellular molecules

    Smooth ER-lipid synthesis

    Nuclear Envelope-separate nucleoplasm from cytoplasm, allow molecules to move in and out of nucleus

    Mitochondria-cellular respiration (production of ATP)

B+C: Cell Compounds + Biological Molecules

1. D	17. D	37. A	55. D	71. A
2. C	19. A	38. D	56. B	72. B
3. D	20. C	39. C	57. C	73. C
4. D	21. B	40. B	58. B	74. A
5. A	22. B	42. A	59. B	75. B
6. D	23. A	43. B	60. A	76. D
7. C	24. B	44. C	61. A	77. C
8. B	25. B	45. D	62. A	78. D
9. D	27. B	47. B	63. C	81. B
10. A	28. C	48. A	64. A	82. D
11. D	29. A	49. C	65. A	83. B
12. D	32. C	50. A	66. D	84. D
13. B	33. D	51. C	67. C	
14. D	34. A	52. B	68. C	
15. B	35. B	53. C	69. D	
16. C	36. A	54. C	70. D	

18. Ribosome, Protein (carrier protein + channel protein, glycoprotein, etc)

26. Nucleotide (DNA-genetic info, code…RNA)

30. See Textbook

31. i) used as a buffer in seminal fluid for the acidic environment in vagina, produced by prostate gland

    ii) carrier of CO_2 in blood plasma

    iii) produced by salivary glands and secreted into mouth-buffer

    iv) produced by pancreas-buffer stomach acid in S.I

41. i) Breakdown in cellular respiration to produce ATP energy

    ii) Polymer of glucose=> cellulose; plant cell wall structure + support

46. ATP (Aenosine Triphosphate), Mitochondrion,
    - carrier proteins (active transport)
    - endo / exocytosis

79. ATP – storage form of energy in cell. High energy bonds b/t phosphates

    Water – solvent, lubricant, temp. regulator, polar molecule

    Phospholipid – make up plasma membrane (bilayer), polar head and nonpolar tails

80. Glucose, polysaccharide
    - short term energy storage
    - structure + support in cell wall (cellulose)

D+E: DNA + Protein Synthesis

1. D	10. C	19. A	28. A	37. C	46. B
2. D	11. A	20. A	29. D	38. A	47. A
3. C	12. B	21. A	30. A	39. D	48. A
4. B	13. D	22. B	31. D	40. C	49. C
5. D	14. D	23. B	32. D	41. C	50. B
6. B	15. D	24. A	33. D	42. D	51. C
7. D	16. C	25. A	34. B	43. D	
8. C	17. C	26. C	35. D	44. B	
9. D	18. B	27. B	36. C	45. D	

52. Transcription
- helicase unwind DNA
- Complementary Base Pairing – RNA nucleotides A=U, C=G
- RNA polymerase join sugar phosphate backbone and check mRNA strand

53. a.

Normal Hb	**Sickle-cell anemia**
• Glutamate • mRNA code to DNA DNA = CTT or CTC	• Valine Mutated DNA = CAT or CAC • Thymine mutated to Adenine in DNA Strand

b.
- Virus
- X-ray
- UV ray
- Pollution
- pesticides

54. a. copying the DNA gene into an mRNA strand

b. Translation: Describe Initiation, Elongation, Termination….producing a polypeptide chain.

55. a. mRNA

b. polypeptide, linear sequence of amino acids, protein

56. a. rDNA: DNA from two or more sources (human insulin gene in Bacteria plasmid)

b. 2 uses of rDNA

i. safer vaccine
ii. insulin for diabetics
iii. genetic modified food
iv. transgenic plants
v. growth hormones

c. nucleus

57. DNA: contains the gene for the enzyme (protein). DNA will unwind and allow an mRNA copy to be formed

mRNA: copy of the DNA gene. Contains codons (triplet code) for each amino acid

rRNA: produced by the nucleolus, found in ribosomes – form ribosomes that facilitate protein production (join amino acids)

tRNA: carry an amino acid to the mRNA- ribosome complex. tRNA anticodon matches mRNA codon (incoming and outgoing tRNA during translation)

58. a. DNA replication: know steps – Unwinding, Complementary Base pairing, Joining. (see notes) Semiconservative replication (parent with daughter strand)

b. A virus is capable of initiating a mutation or changing the DNA code.

59.

RNA	DNA
• ribose	• deoxyribose
• U, A, G, C (Uracil)	• T, A, G, C (Thymine)
• found in nucleus and cytoplasm	• found in nucleus
• 1 strand	• 2 strands

60. a. i) Describe Transciption: see above

ii) Radioactive Uracil found in mRNA strand. During transcription, radioactive uracil combined with DNA adenine- complementary base pairing and then RNA polymerase joined the mRNA strand together.

b. DNA will **not** be radioactive. no uracil in DNA!!!

61.

	Translation	Replication
Product	amino acid chain/protein	two identical DNA helices
Location	cytoplasm	nucleus

62. see # 57

63. (3 marks)

Tissue Sample A	Tissue Sample B
• lost contact inhibition (multiple layers)	• contact inhibition (single layers)
• abnormal nuclei	• normal nuclei
• disorganized growth	• organized growth
• oncogene	• proto-oncogene
• cell undifferentiated	• cell differentiated

64. a. reading the mRNA code – allow for two tRNAs to attach anticodon with codon – polypeptide formation
b. adenine from RNA nucleotide complementary pairing with thymine nucleotide during transcription
c. high energy bond. tRNA carry specific amino acid to site of protein synthesis
d. joining of amino acids in forming polypeptide (primary structure)

65. tRNA - carry specific amino acid to site of protein synthesis, anticodon matches codon of mRNA.

Ribosome – site of protein synthesis – joining amino acids together

mRNA – contains codons, genetic code from DNA – each codon represents one amino acid. (copy of protein blueprint)

66.

	DNA	**RNA**
TYPE OF SUGAR	deoxyribose	ribose
NUMBER OF STRANDS	2	1
BASES	T, A, C, G	U, A, C, G

67. see # 71.

68. see # 56.

69. see # 57.

70. DNA and mRNA: copy of the protein gene

mRNA and tRNA: use triplet codes for amino acids – codon and anticodon, both contain uracil

tRNA and amino acid: tRNA carry amino acid to site of protein synthesis

protein and rRNA: both found in ribosomes (small and large ribosomal subunits) produced by the nucleolus

71. Don't worry about this one!

72.

	DNA	**RNA**
BASES	C, G, A, T	C, G, A, U
LOCATION	nucleus	nucleus and cytoplasm
NUMBER OF STRANDS	2	1

73. a. secondary protein structure, hydrogen bonding between polar peptide bonds
b. tertiary protein structure, R-group bonding – ionic, covalent, hydrogen
c. primary protein structure, peptide bonds between amino acids

F: Cancer

1. C	8. A	15. D	22. D
2. D	9. B	16. C	23. D
3. A	10. D	17. A	24. D
4. A	11. D	18. C	25. C
5. A	12. A	19. C	26. C
6. B	13. D	20. B	27. B
7. C	14. B	21. A	28. A

29. a. tissue sample A

b. (2marks)

- lost contact inhibition (multi-layers)
- abnormal nuclei (irregular # of chromosomes)
- disorganized growth

30. Initiator - cause protoncogene to oncogene (then changes in cell, see above)

Promotor - cause cell division

Anaplasia - formation of tumour

Neoplasia – invading underlying tissue

Vascularization - blood and lymph vessels into cancer growth

Metastasis - spreading of cancer to secondary site of growth

31. The developing of cancer, same steps as 30

G: Transport Across Cell Membrane

1. D	7. D	14. A	20. C	31. B	43. C
2. C	8. A	15. D	21. D	37. C	44. C
3. B	9. A	16. D	23. D	39. C	45. B
4. C	10. B	17. A	25. C	40. C	46. C
5. C	11. A	18. B	27. A	41. A	47. C
6. C	13. A	19. D	30. B	42. C	48. A

12. (4 marks)

i. charges of molecules (ions, polar vs. non polar or fat-soluble)
ii. size of molecules
iii. shape of molecules
iv. temperature
v. [gradient]

22/29. **Diffusion**: movement of molecules from high to low concentration across the plasma membrane

Osmosis: water moves from [high to low] through protein channel.
Water moves towards high solute!!!

Facilitated transport: from [high to low] w/ the help of protein carrier

Active transport: from [low to high] w/ the help of protein carrier-uses energy in the form of ATP.

24. Oxygen: **Diffusion** - from high to low concentration through the phospholipid membrane towards inside of cell. (High PO_2 - low PO_2)

Marcromolecules: **endocytosis (pinocytosis)** - infolding of plasma membrane forming a vesicle inside the cell

26.a) A semipermeable membrane allow certain molecules to pass usually based on size. The living plasma membrane is selectively permeable, but some molecules, such as water can pass freely through membrane.

b) Amylase broke down starch into **maltose**: small enough to pass through semipermeable memberane, from high to low concentration.

28.a) Active transport

b) Sodium potassium pump to establish high concentration of sodium on the outside and potassium on the inside of a neuron to allow for impulse transmission - action potential to take place.

c) ATP - provide energy for active transport

d) carrier protein that binds to sodium or potassium and moves them across the membrane

29. See # 22

32.

Active Transport	Passive Transport
• use carrier protein	• may use carrier protein or simple diffusion through phospholipid membrane (fat-soluble) or channel proteins
• [low to high]	• [high to low]
• requires ATP energy	• does not require ATP energy
• Sodium/Potassium pump	• glucose and amino acids use facilitated transport (carriers)

33. Animal cells have crenated = placed in a hypertonic solution (greater solute in the solution), water moves to the higher concentration of solute outside the cell, so the cell shrinks.

34. Refer to graph in question #36. Because isotonic after 3 hours, water moved equally back and forth across plasma membrane, so cell maintained its shriveled size.

35. Selectively permeable because it is able to control which molecules can pass through it.

Osmosis: water moving high to low concentration (towards high solute) using channel proteins because water is polar and has difficulty moving through the middle/hydrophobic layer created by phospholipids.

Facilitated trans: high to low concentration using carrier proteins, eg. glucose

Pinocytosis: endocytosis of macromolecules that are too big for channels and carriers. Vesicle formation going from the plasma membrane towards the inside of cell - bring macromolecules into cell.

36.a) cells were placed into a hypotonic solution (higher solute inside the cell than in the solution) water diffuses into the cell, the cell swells and gains mass.

b) swells => bursts/lyses

38.a) cells gained mass, water moved into cell (hypotonic solution)

b) cells lose mass, water moves out (hypertonic solution)

c) equal solute in cell and in solution, water moves equally in both direction and cell size is maintained (isotonic solution)

49.a) **Osmosis (osmotic pressure)**: water moves from high to low concentration or water moves towards a higher concentration of solute

b) Potato disk was place in a hypertonic solution, water moved towards the higher solute outside the cells therefore the potato cells lose mass.

c) Practice graphing!!!! See note for two examples!!! Do Not connect dots!! Use best fit line on or between points. 0 change in mass of cell (line straight across from y axis and down to the x axis) will determine the % solute of the isotonic solution.

50.a) **Control** for experiment- should have the equal amount of solute in cells from same potato.

b) **Graph points from table and use best fit line.**

c) Same as c) in question #49.

d) Higher solute inside the potato mass, therefore water entered the cell through osmosis and the cubes gained mass

Section H: Enzymes

1. c	7. b	13. b	19. c	25. d
2. d	8. c	14. b	20. a	26. a
3. c	9. a	15. d	21. a	27. b
4. a	10. b	16. b	22. a	28. c
5. d	11. d	17. d	23. b	29. c
6. a	12. b	18. c	24. a	30. a

31. • $0^{\circ}C - 35^{\circ}C$: increase in successful collisions between substrate and enzyme

- $37^{\circ}C$: optimal conditions - most successful collisions - hotter will cause enzymes to denature
- $45^{\circ}C$ - $55^{\circ}C$: enzyme denature: bonds broken and protein shape is change so it can no longer interact with substrate

32. a. • as the amount or concentration of substrate is increased, rate of rxn increases because more enzymes will collide with substrate

- graph plateau because all enzyme active sites are full (saturated) with substrates

b. The graph would go down because the acid would denature the enzymes in the small intestine and decrease the rate of reactions, less product formed.

33. Please read the information in question #38 to answer a., b., c. (sorry)

a. graph data

b. interpret your graph…time for 10ml for pH6.5.

c. the time increases as the pH changes from 8-12 because enzymes denature….slower rate of reaction, etc.

34. a.

i. Increase substrate w and x
ii. Increase enzyme solution 1 and 2
iii. Introduce a competitive inhibitor for enzyme solution 3.

34. b. The substance could be a competitive inhibitor that attaches to enzyme 2 and prevents substrate x from forming product y.

35. a. increase in heat energy from 35 to 37 will increase the kinetic energy of the molecules and therefore increase

the chance for successful collisions between enzyme and substrate (protein and pepsin in the stomach).

b. a competitive inhibitor will compete with protein for the active site of pepsin and therefore the rate of reaction will decrease

c. Optimal stomach pH is 2-3. If the environment is changed to pH 8, the pepsin enzyme will denature and no longer be able to catalyze reactions.

36.

Temperature (°C)	Consumption of oxygen (mL/hour)	
	Sample A muscle tissue	Sample B muscle tissue + thyroxin
15 °C	6	12
25 °C	8	16
35 °C	12	24
45 °C	7	14
55 °C	2	4

b. Amount of Oxygen consumed: 13-14mL/hour

c. Thyroxin caused an increased rate of metabolism, increased ACR where Oxygen and glucose are consumed at a faster rate.

d. Use your knowledge of temperature and rate of reaction. Low temperatures, less successful collisions, lower reaction rate and therefore less oxygen consumed by cells (15°C). As you increase the temperature (35°C), more collisions, rate of reaction goes up and more oxygen is consumed. Beyond 40°C, enzymes begin to denature so the reaction rate decreases and less oxygen is consumed (55°C).

37 a. **Control test tube**, no salivary amylase was added, therefore should remain black and not turn yellow.

b. graph the temperature along the x-axis and time along the y-axis. Plot only the first initial time when it changed to yellow at each specific temperature. (eg. at 0°C, 4 min; 20°C, 3 min.; 40°C, 2min; etc.)

c. Explain temperature and rate of reaction again....(see above #36). Note, at 60°C, even though the enzymes had denatured, the reaction still took place at 5min. Remember that enzymes speed up the reaction, denatured enzymes, reaction took longer and a greater amount of activation energy was necessary.

38. This information goes with question #33, sorry.

a. The shape of the substrate fits exactly with the shape of the enzyme active site. Therefore enzymes are always specific to their substrate. (eg. maltase = only to maltose)

b. Denaturation is when the bonding of the protein structure is affected. (eg. break hydrogen bonds) This changes the shape of the enzyme and no longer allows it to interact with its substrate to catalzye reactions.

39. a. graph pH on x-axis and mass of remaining egg white of y-axis. Note the lower the amount of egg white remaining the quicker the reaction.

b. The optimum pH for Pepsin is pH 2.

c. Pepsin enzyme denatures.....alter bonds and change protein shape of pepsin

I: Digestive System

1. C	11. B	21. D	31. B	41. A	51. D	61. B
2. B	12. C	22. B	32. C	42. B	52. A	62. D
3. B	13. A	23. B	33. B	43. B	53. C	63. D
4. B	14. A	24. B	34. C	44. C	54. C	64. C
5. C	15. C	25. C	35. D	45. D	55. D	65. D
6. A	16. B	26. B	36. A	46. C	56. C	66. A
7. A	17. D	27. D	37. B	47. A	57. B	67. B
8. A	18. C	28. A	38. A	48. D	58. B	68. A
9. C	19. D	29. D	39. B	49. A	59. D	
10. A	20. A	30. C	40. D	50. C	60. B	

69.a) Small intestine produces maltase (intestinal juice) which broke down maltose into glucose + glucose

b) No bile from liver/gallbladder to emulsify and no lipase from pancreas to digest fat.

c) Maltase + peptidase require basic pH

d) Trypsin broke down egg whites into peptides and the piece of small intestine produced peptidase that hydrolyzed peptides into amino acids. Amino acids found in solution after 1 hour!!

70. 7 functions of liver - pick any four - Detoxifies blood, make plasma proteins, produces bile; store glycogen, destroy RBC's, produce urea.

71. Presence of fat in duodenum causes release of bile from gall bladder into duodenum. Bile emulsifies fat into droplets to give polar ends to the neutral fat and to increase surface area. Lipase from pancreas enters duodenum to chemically digest fat dropletsè Glycerol + Fatty acids. It gets absorbed (intestinal villi), recombined into lipoproteins, into lacteal of lymphatic system.

72.

Salivary Gland	Salivary Amylase	Maltose
Gastric Gland	Pepsin	Peptides
Intestinal Gland	Maltase	Glucose
	Peptidase	Amino acid
	Nuclease	Nucleotides/monosaccharide and nitrogen bases.

73.

Stomach = 1	Large Intestine = 5
Liver = 4	Small Intestine = 7
Appendix = 6	Pancreas = 8

74. X = intestinal juice, Y = pancreatic juice

a) Test tube 1 (starch) will be digested by pancreatic amylase to maltose. In turn maltose is digested by intestinal maltase into glucose molecules.

Test tube 2 (fats) - no bile in the test tubes to emulsify the fats into fat droplets. Lipase is present from pancreatic juice, but is difficult to break down or hydrolyze non polar neutral fats if not emulsified first. Fats still present.

b) blue litmus to red = acid buffered to base. Pancreas produces sodium bicarbonate that buffered the acidic environment in test tube #3.

75. a) Pick one of seven functions, see above.

b) -Produces plasma proteins

-Destroys old red blood cells

-Detoxifies blood

-Controls blood glucose levels

c) -Excretes bile - contain the breakdown products of hemoglobin - bilirubin and biliverdin

76. Starch + **Salivary Amylase**(in mouth) + **Pancreatic Amylase**(in S.I) → Maltose
Maltose + **Maltase**(in S.I) → Glucose

77. a) No change - no enzyme/ control!

b) Little digestion or none - pepsin not activated

c) Digestion - pepsin activated at optimum pH - best results

d) little digestion - pepsin enzyme is missing

78. a) X= Enzyme - Maltase

Y= Substrate - Maltose

b) All enzyme active sites are saturated with maltose, therefore rate of reaction does not increase.

c) Rate of reaction will decrease because lead is a heavy metal that will denature or change the shape of the enzyme so it can no longer catalyze the reation.

79. a) Reabsorbs H2O + Salts, contain bacteria that produce Vitamins that are reabsorbed, compact feces

b) X= Stomach è Pepsin for protein

Y= Pancreas→ Trypsin(protein), Lipase(lipid), Amylase(starch), Nuclease(nucleic acids)

80. a) Secret Trysin, Lipase, Amylase, Nuclease

Produce Insulin + Glucagon

Bicarbonate ions neutralize acidic chime

b) Y = Rectum - Store and expel feces

81. Fat→ Produces bile + stores in gall bladder. Bile emulsifies fat into fat droplet.

Blood Glucose→ stores glucose as glycogen (energy storage). When blood glucose is low, Glycogen is converted to glucose and released into blood. (insulin stimulates storage of glucose)

Healthy Blood→ destroy old RBC, detoxify blood, produces plasma proteins, etc.

82.

- Lipase - emulsified fat droplets into glycerol and fatty acids
- Trypsin - Proteins into peptides
- Amylase - Starch into maltose
- Nuclease - DNA/RNA into nucleotides
- Sodium Bicarbonate - buffer acidic chyme
- **Insulin** - lower blood glucose level

83. Digestion - produces intestinal juice containing the enzymes maltase, peptidase and nuclease to finalize the breakdown food into monomers for absorption

Absorption - very large surface area for absorption:

- folded lumen containing millions of intestinal villi
- villi contain columnar epithelial cells with microvilli
- diffusion, facilitated and active transport of monomers into capillary network and lacteal in villi (pick up products of absorption)

84. Pepsin

- produced by gastric glands in stomach
- hydrolyze proteins into peptides

Nuclease

- produced by pancreas and small intestine
- breakdown DNA/RNA into nucleotides and Nucleotides into monosaccharides and nitrogen bases (phosphates released)

J/K: Heart + Circulation

1. D	22. C	43. B	64. D	85. D
2. C	23. D	44. C	65. D	86. A
3. D	24. D	45. B	66. C	87. B
4. D	25. C	46. D	67. D	88. C
5. B	26. C	47. C	68. A	89. D
6. A	27. C	48. B	69. A	90. B
7. C	28. D	49. B	70. D	91. D
8. B	29. B	50. B	71. C	92. D
9. A	30. A	51. B	72. D	93. C
10. D	31. D	52. D	73. A	94. B
11. A	32. B	53. D	74. A	95. A
12. D	33. C	54. A	75. D	101. A
13. B	34. A	55. B	76. C	108. A
14. D	35. C	56. A	77. D	
15. A	36. C	57. B	78. A	
16. A	37. A	58. B	79. C	
17. A	38. D	59. D	80. B	
18. C	39. D	60. B	81. C	
19. D	40. B	61. D	82. D	
20. C	41. C	62. D	83. D	
21. C	42. B	63. C	84. C	

96. a.

BLOOD VESSEL	LETTER FROM DIAGRAM
Iliac artery	U
Aorta	Z
Carotid artery	W
Subclavian artery	X

b.

	HEPATIC VEIN	HEPATIC PORTAL VEIN
CONTRAST 1	lower glucose and amino acids leaving the liver	high glucose and amino acids carried to the liver
CONTRAST 2	higher urea leaving liver	lower urea to liver/more toxins

c. Name: oval opening

Function: join right atrium and left atrium (bypass the lungs)

Name: Venus duct

Function: join umbilical vein to the inferior (posterior) vena cava

Name: Arterial duct

Function: join pulmonary artery to the aorta (bypass the lungs)

97. pulmonary vein:

- high oxygen, low carbon dioxide

pulmonary artery:

- high carbon dioxide, low oxygen

posteror vena cava:

- high carbon dioxide, low oxygen

aorta:

- high oxygen, low carbon dioxide

umbilical vein:

- high oxygen, low carbon dioxide

umbilical artery:

- high carbon dioxide, low oxygen

98. Component X: White blood cells (leukocytes)
Function: fight infection- phagocytes devour invading cells/viruses

Component Y: Red blood cells (erythrocytes)
Function: contain hemoglobin, transport oxygen, carbon dioxide, hydrogen ions

Component Z: Platelets (thrombocytes)
Function: blood clotting, coagulation

99. Artery - Thick wall with a well-developed middle layer of smooth muscle and elastic tissue. Allow the artery to expand and recoil because of high blood pressure and velocity.

100. an antigen enters the blood:

- WBCs phagocytize invading cells, B-cells produce antibodies that are specific to the antigen; attach to antigen - agglutination.

increased stimulation by the sympathetic nervous system:

- divert blood away from digestive system and towards muscles
- increase heart rate and increase volume of blood with each contraction
- increase blood pressure - vasoconstriction
- increase blood glucose level

hardening of the arteries (inability of arteries to expand and recoil):

- hypertension - blood pressure increases, strain on heart and other blood vessels

a cut on your finger:

- platelets stimulate a blood clot to be formed (clot = fibrin protein and formed elements) (remember the steps)

102. a. **Vein X**

Name: Jugular Vein
Function: Return deoxygenated blood (high in bicarbonates and reduced hemoglobin) from the head, face and neck to the superior (anterior) vena cava.

Vein Y

Name: Inferior (Posterior) Vena Cava
Function: Receives deoxygenated blood (high in bicarbonates and reduced hemoglobin) from lower body, below the heart, and transports it to the right atrium.

b. i. **oval opening** - joins right atrium and left atrium. function to divert blood away from the lungs

ii. mixing of oxygenated and deoxygenated blood (baby looks blue)

103. a. X = Coronary Artery

- myocardium (heart muscle) does not receive oxygen and nutrients
- heart cells die
- heart attack

b. When the left ventricle contracts, blood would go up/back into the left atrium.

104. Artery: Thick wall with a well-developed middle layer of smooth muscle and elastic tissue. Allow the artery to expand and recoil because of high blood pressure and velocity.

Semi-lunar valve: a three-flap valve that allows blood to pass in one direction from the ventricles to the attached vessels (pulmonary trunk, aorta).

Capillary: one cell thick, allow for exchange to take place.

105.

PART OF THE BLOOD	COMPONENT NAME	SOURCE	FUNCTION
plasma	water	large intestine reabsorbs large volume of water, kidney reabsorbs water to maintain blood volume	maintaining blood volume
plasma	plasma proteins	liver	• maintaining blood volume, pressure and pH • clotting
formed elements	platelets	bone marrow	blood clotting
formed elements	white blood cells, leukocytes	bone marrow	fighting infection
plasma	glucose	absorbed by intestinal villi	source of nutrients for cells, used by mitochondria in production of ATP - energy

106. a. Vessel Y: **Arteriole (branching from mesenteric artery)**

b.

i. increase glucose
ii. increase amino acids
iii. increase carbon dioxide (bicarbonates, carboxyhemoglobin, HHb)
iv. increase toxins
v. increase monosaccharides from digestion of DNA/RNA - ribose, deoxyribose

c. Between time P and Q less glucose is being absorbed by the intestinal villi. This could be caused by prolong periods without eating or between meals. LESS Absorption of Glucose.

107. a.

BLOOD VESSEL	AVERAGE BLOOD VELOCITY (cm/s)	AVERAGE BLOOD PRESSURE (mm/Hg)	TYPE OF BLOOD VESSEL
A	45.0	100	artery
B	0.5	22	capillary
C	15.0	60	arteriole
D	25.0	2	vein
E	4.0	10	venule

b. Vessel A: Artery - high pressure and velocity caused by the ventricular contraction. Vessel moving away from the heart.

Vessel B: Capillary - large cross sectional area, pressure and velocity decrease significantly for exchange to take place.

c. Sympathetic Nervous system stimulate the adrenal medulla to release epinephrine and norepinephrine into the blood - fight or flight response.

109. a. RBC: transport oxygen, carbon dioxide, hydrogen ions

WBC: fight infection

Platelets: blood clotting

b. RBCs are produced in **red bone marrow** found in long bones.

110. a. Structure X: Right Ventricle contains deoxygenated blood

Structure Y: Left ventricle contains oxygenated blood

b. Thick myocardium wall to pump blood:

- Right ventricle to pulmonary loop (lungs)
- Left ventricle to systemic loop

111. a. Increase in skeletal muscle mass requires increase number of capillaries. Increase oxygen and nutrients to muscle, and increase carbon dioxide and waste taken away from muscles during exercise.

b. The ventricles pump out a greater volume of blood with each contraction.

112. Structure W

Name: Right Atrium
Function: Collects deoxygenated blood from the superior and inferior vena cava, pumps blood into right ventricle.

Structure X

Name: Aorta
Function: Largest blood vessel, leaving left ventricle, supplies systemic system/loop or body with oxygenated blood.

Structure Y

Name: Pulmonary semi-lunar valve
Function: Opens to allow blood to pass in one direction from the right ventricle into the pulmonary trunk.

Structure Z

Name: Chordae Tendineae
Function: Prevent the AV valve (atrioventricular valve) from inverting when the ventricles contract - keep blood from going back up into atria.

113.

	RBC	**Platelets**
Structural Description	biconcave disks, no nucleus at maturity, contain hemoglobin	non-cellular, fragments of larger megakarocytes
Function	transport oxygen, carbon dioxide, hydrogen ions	blood clotting or coagulation
Site of Production	red bone marrow	red bone marrow

L: Respiratory System

1. C	12. D	23. C	34. B	45. B	56. B
2. A	13. B	24. C	35. A	46. A	57. A
3. A	14. B	25. C	36. A	47. D	58. D
4. A	15. B	26. A	37. A	48. A	59. D
5. See #45, A	16. A	27. A	38. C	49. B	60. B
6. A	17. B	28. B	39. D	50. D	61. A
7. C	18. D	29. C	40. C	51. C	62. A
8. C	19. D	30. D	41. B	52. C	63. A
9. C	20. B	31. C	42. D	53. D	64. B
10. A	21. A	32. D	43. B	54. C	
11. A	22. C	33. D	44. B	55. B	

65. i. thin walls (squamous epithlial cells) for easy gas exchange
ii. large surface area for gas exchange
iii. contain a surfactant of lipoproteins that decrease surface tension to prevent collapsing
iv. surrounded by pulmonary capillaries for exchange of oxygen and carbon dioxide

66. i. Nose contains hair and mucous membrane to trap dust/debris in inhaled air.
ii. Trachea contains mucus and cilia to trap and sweep debris up to be swallowed.

67. The pleural membranes surrounding the lungs have a lower pressure (4mm Hg) to facilitate the lower pressure in thoracic cavity that draws air into lungs (maintains residual volume). Medulla Oblongata stimulates the diaphragm to contract and lower and the external intercostal muscles to contract to lift the ribs up and out. This increases the size of the thoracic cavity and lowers its pressure - draws air into lungs due to lower pressure. (negative pressure, partial vacuum formed)

68. a. High CO_2 and H+ ions increase during exercise and stimulate the medulla to increase breathing rate.

b. $CO_2 + H_2O \rightarrow H_2CO_3 \rightarrow H^+ + HCO_3^-$

c i. a change in pH away from optimal conditions cause enzymes to denature

ii. temperature change, substrate concentration, inhibitors.

69. a. Rate of cell division in the bone marrow:

- Smaller partial pressure gradient for oxygen at higher altitudes - erythropoeitin will be released by the kidney due to oxygen tension. Stimulates bone marrow to produce more red blood cells.

breathing rate:

- breathing rate will increase due to oxygen tension or less oxygen in the blood

b. Carbon dioxide production increases, combines with water to form carbonic acid that decreases pH. Carbonic acid dissociates into H+ and bicarbonates. H+ is picked up by Hb to form HHb. Buffer system!!

70. See #65

71. a.

LETTERS	STRUCTURES
W	Alveoli
X	Medulla Oblongata
Y	Rib Cage
Z	Diaphragm

b. See #67

c. The pleural membranes surrounding the lungs have a lower intrapleural pressure (4mm Hg) to facilitate the lower pressure in thoracic cavity that draws air into lungs (maintains residual volume and prevents lung from collapsing).

72. a.

i. oxygen combines with hemoglobin to form oxyhemoglobin
ii. carboxyhemoglobin releases carbon dioxide
iii. reduced hemoglobin releases hydrogen ions which combine with bicarbonates to form carbonic acid → break apart into water and carbon dioxide (see equations in text/notes)

b.

i. lower temperature --> 37°C (38° in tissues)
ii. higher pH --> 7.4 (7.38 in tissues)

73. a. Higher CO_2 is picked up by chemoreceptors in aortic and carotid bodies. They send a message to the Medulla Oblongata to increase stimulation to diaphragm and rib muscles - increase breathing rate to get rid of excess CO_2.

b. oops, see answer above. I explained it above.

74. a. Internal respiration is the exchange between the systemic blood capillaries and tissue. Blood has a higher partial pressure of Oxygen - oxygen diffuses into tissue. Tissue has a higher partial pressure of Carbon dioxide - CO2 diffuses into blood. Partial pressure gradient provided by aerobic cellular respiration in tissue cells. Use oxygen and produce carbon dioxide.

b. pH of the blood is maintained by a bicarbonate, reduced hemoglobin buffer system with carbonic acid. (see notes and equations)

75.

SUBSTANCE TRANSPORTED	FORM OF HEMOBLOBIN
oxygen	oxyhemoglobin
carbon dioxide	carboxyhemoglobin or carbaminohemoglobin
hydrogen ions	reduced hemoglobin

Section M/N: Nervous System

1. a	14. c	27. d	40. b	53. a	67. b
2. a	15. d	28. b	41. c	54. d	68. b
3. a	16. c	29. a	42. b	55. b	69. b
4. a	17. b	30. d	43. b	56. c	70. d
5. c	18. c	31. d	44. c	57. d	71. a
6. b	19. d	32. b	45. a	58. a	72. a
7. b	20. a	33. d	46. a	59. c	73. d
8. c	21. c	34. d	47. d	60. c	74. c
9. d	22. c	35. c	48. c	61. c	75. c
10. c	23. b	36. d	49. b	62. d	89. d
11. d	24. b	37. b	50. d	63. a	
12. d	25. a	38. c	51. c	64. c	
13. b	26. a	39. d	52. a	65. c	

65. X= cerebrum: conscious brain - speech, understanding, vision, voluntary movement of limbs, learning, memory, etc.

Y= thalamus: relay switchyard that passes sensory stimulus to cerebrum

Z= cerebellum: fine motor coordination of skeletal muscles, posture, etc.

76. a. Name: Motor Neuron

Role: takes a message away from the CNS to an effector (muscle or gland).

b. Name: Sensory Neuron

Role: takes a message from a receptor to the CNS.

c. Name: Interneuron

Role: found in the CNS, interprets incoming sensory stimuli and conveys messages b/t parts of the nervous system including a message to the motor neuron for a reflex response.

77. a. Structure X: Axon bulb with presynaptic membrane

Structure Y: Dendrite with post synaptic membrane

b. Substance: Neurotransmitters

Function: Excitatory neurotransmitters will stimulate receptors on the postsynaptic membrane and drive towards threshold - depolarizing, open sodium gates on dendrite. Inhibitory neurotransmitters - away from threshold.

c. Arrow goes straight down on diagram.

78. a&b. Plot the diagram from #83.

upswing - depolarization, downswing- repolarization, recovery phase....see notes and #81.

c. Potassium gates open, potassium diffuses from the axoplasm to the outside of axon. Voltage moves from +40mv to -65mv in axoplasm.

d. Refractory period- gates will not open to keep the impulse going in one direction and the sodium/potassium pump restores resting potential (active transport - sodium out and potassium in)

79. a. Structure X:

Name: Sensory neuron
Function: impulses from receptors to the CNS

Structure Y:

Name: Interneuron
Function: found in the CNS, interprets incoming sensory stimuli and conveys messages b/t parts of the nervous system including a message to the motor neuron for a response or movement.

b. drugs, inhibitors, pesticides, etc. Cause over/under stimulation of receptors on postsynaptic membrane of interneuron dendrite - flooding the synaptic cleft with interneurons all at once, denature enzymes that clear the receptor site, inhibitors

blocking the receptor sites so that communication can't take place. (these are just a few examples)

80. a. from left to right #1,5,2,6.

b. **Reflex Arcs**

- have survival value and affect an immediate response while interneurons send appropriate information to the CNS (brain) for evaluation and response refinement

Path of Reflex: **Stimulus**, receptor, sensory neuron to CNS, interneuron, motor neuron away from CNS, effector (muscle, gland), **response (see diagram in notes/text)**

81. **Action Potential**

- **stimulation of neuron to carry an impulse** - caused by electric shock, pinch, or sudden change in pH
- minimum voltage change needed to trigger an action potential is called the **threshold**. Once threshold is reached, membrane no longer depends on the strength of the stimulus
- action potentials are **all-or-nothing events:**
- if threshold is reached all the associated membrane permeability changes will occur. If threshold is not reached, they will not occur at all

a. Depolarization (upswing)

- **sodium** rapidly moves across membrane **into axon** through channels called the **sodium gates**
- change from –65 to + 40 mv in axoplasm
- axon becomes **depolarized**

a. Repolarization (down swing)

- **the potassium gates opens** and K^+ ions **exit** axoplasm – move through channels to the outside of the neuron
- change from +40mv to –65mv in axoplasm
- axon becomes **repolarized** (negative again)

Recovery Phase

- "when an impulse has passed each successive portion of a fiber it undergoes a **refractory period** when it is unable to conduct an impulse" pg.308
- **during the recovery phase:**
- fiber rests, gates do not open
- refractory period allows impulse to go in one direction
- the sodium-potassium pump returns Na^+ ions to the outside and K+ ions to the inside (active transport)

- nerve may be stimulated again after recovery phase

saltatory conduction on myelinated neurons - action potentials at nodes of Ranvier.

82. a. Any change in the environment that can open sodium gates is called a(n) **stimulus**. If the change in the environment does not open a sodium gate then the **threshold** has not been reached. When an action potential is produced, it is called the **all-or-none** response. During the **recovery phase**, no further action potentials can be generated.

    b. see action potential in #81

    c. Schwann cells secrete a myelin sheath around neuron fibres. **saltatory conduction on myelinated neurons - action potentials at nodes of Ranvier, gates only open at the nodes therefore speed of transmission is increased.**

83. From 1 to 3 milliseconds: **Depolarization** - sodium gates open and sodium diffuses into axon

    From 3 to 5 milliseconds: **Repolarization** - potassium gates open and potassium rushes out of axon.

    From 5 to 7 milliseconds: Recovery Phase - gates do not open, sodium potassium pump restores resting potential.

84. a. Repolarization and Recovery Phase, see above.

    b. Repolarization would not take place, potassium could not diffuse out of axon. **Axomembrane would remain at +40mv - depolarized.**

85. Na+/K+ pump: Establishes membrane potentials - high sodium concentration on the outside and high potassium concentration on the inside - resting potential.

    synaptic vesicles: contain neurotransmitters that are released at the synapse - communication between axon bulbs and dendrites.

    myelinated axon: saltatory conduction - quick transmission of impulses

86. Myelin sheath: insulates and protects neuron fibres and speeds up conduction.

    Effector: a response to the stimuli - eg. muscle contraction

    Interneuron: see previous question

    Receptor: receives the stimuli, threshold, generates an impulse on sensory neurons.

87. Structure X:

Name: Cerebrum (Frontal lobe)
Function: conscious area of brain involved w/ higher thought, judgement; skeletal muscle control.

Structure Y:

Name: Cerebellum
Function: co-ordination of fine motor movements (muscle co-ordination)

Structure Z:

Name: Medulla Oblongata
Function: control of heart rate, breathing rate, vomiting, coughing, etc. ANS (autonomic nervous system)

88. a. release of neurotransmitters - **exocytosis**

b. **diffuses** across the synaptic cleft

c. can cause the dendrite (postsynaptic membrane) to depolarize and open sodium gates....

90. a. see #81

b. Neuron transmissions are all-or-nothing events. Repeated simulation by neurons will reflect the strength of the stimuli and therefore allow the CNS to generate an appropriate response.

91. Action potential - see #81

92.

STRUCTURE	NAME	FUNCTION
V	Sensory Receptors	receive stimuli, threshold
W	Sensory Neuron	message towards CNS
X	Interneuron	interpret, connect....
Y	Motor Neuron	message away from CNS
Z	Effector	response to stimuli

93. a. Structure X: ??? dendrite of motor neuron (poor diagram)

Structure Z: axon bulbs

b. action potential see #81

c. without myelin sheath - all gates must open during action potential - no jumping, slower conduction.

94. a. Structure X: interneuron

b. Function for Structure Y: receptor (see above)

O: Urinary System

1. B	12. A	23. A	34. D	45. C	56. A
2. C	13. D	24. B	35. C	46. D	57. B
3. B	14. D	25. A	36. B	47. D	58. C
4. A	15. A	26. D	37. D	48. B	59. A
5. D	16. B	27. A	38. D	49. C	60. B
6. B	17. B	28. A	39. B	50. A	61. D
7. C	18. A	29. D	40. C	51. C	62. B
8. C	19. D	30. A	41. B	52. D	64. D
9. B	20. B	31. D	42. A	53. A	65. D
10. A	21. B	32. C	43. B	54. C	66. D
11. C	22. C	33. B	44. C	55. A	

63. Kidney:

i. produces urine, removes urea and other forms of metabolic wastes from blood
ii. controls blood pH
iii. controls blood volume and pressure
iv. produces erythropoietin to stimulate RBC production from bone marrow

Collecting duct:

i. reabsorption of water
ii. leak urea to add to the hypertonic environment in renal medulla
iii. passage of urine from nephron to the renal pelvis

Proximal tubule:

i) and ii) tubular reabsorption - reabsorb glucose, amino acids, Na+ and water from proximal convoluted tubule into peritubular capillaries (blood).

67. Structure X:

Name: Ureter
Function: transport urine from kidney to urinary bladder

Structure Y:

Name: Urinary bladder
Function: stores urine, contract during urination

Structure Z:

Name: urethra
Function: passage of urine to outside of body (also passage of semen in males)

68. Bowman's capsule: contains podocyte cells that form pores for glomerular filtration. Receives the filtrate from the glomerulus- pressure filtration.

Proximal convoluted tubule: tubular reabsorption, see #63

Loop of Henle: reabsorption of water, descending limb, reabsorption of salt, ascending limb.

Distal convoluted tubule: tubular secretion (excretion) - active transport of penicillin, uric acid, creatinine, H+ ions, ammonia from blood into distal convoluted tubule.

Collecting duct: reabsorption of water, and leak urea for hypertonic environment in renal medulla. Excrete concentrated urine.

69. Structure W:

Name: afferent arteriole
Function: connect renal artery to glomerulus, supply blood for pressure filtration in glomerulus.

Structure X:

Name: proximal convoluted tubule
Function: tubular reabsorption - explain!! (see above)

Structure Y:

Name: distal convoluted tubule
Function: tubular secretion (excretion) explain!! (see above)

Structure Z:

Name: Descending limb of loop of nephron (henle)
Function: reabsorption of water

70. a decrease in blood pressure:

- juxtaglomerular appartatus produces renin
- adrenal cortex releases aldosterone which causes kidney to reasorb Na+ and water to increase blood volume and pressure.

a decrease in blood pH:

- more **H+** and ammonia excreted in urine
- more Na+ and **bicarbonates** reabsorbed into blood

71. a. 100% reabsorption of glucose at the proximal convoluted tubule

b. More important for animal to reabsorb as much water as possible to prevent dehydration. Longer loop of nephron into the renal medulla gives a better chance for increase water reabsorption.

72. one function of each

i. Glomerulus: Glomerular filtration - explain
ii. Aldosterone: cause increase Na+ and water reabsorption from kidney, increase blood plasma volume.
iii. Ureter: urine from kidney to urinary bladder
iv. Distal convoluted tubule: tubular secretion - explain
v. Urinary bladder: store urine
vi. Peritubular capillary network: surround the nephrons - secretion or reabsorption of substances during urine formation.
vii. Renal pelvis: connects collecting ducts with ureter. Funnels urine out of kidney.
viii. Afferent arteriole: connect renal artery to glomerulus, supply blood for pressure filtration in glomerulus.

73. ureter: see above

collecting duct: see above

antidiuretic hormone (ADH): causes reabsorption of Na+ and water at the distal convoluted tubule and collecting duct.

renal pelvis: see above

glomerulus: pressure filtration - filtrate into bowman's capsule.

74. Two ways:

- Juxtaglomerular apparatus will detect lower pressure for filtration because of low blood volume and then it will release renin. Aldosterone will be released by adrenal cortex and causes Na+ and water to be reabsorbed by kidney.
- High blood solutes will be detected by the hypothalamus causing ADH (antidiuretic hormone) to by released by the posterior pituitary - cause water to be reabsorbed by the distal convoluted tubule and collecting duct. Increase blood volume.

75. a.

b. Name: Aldosterone or ADH- see question #74

76. **Not Urea!!!!!**

i. uric acid
ii. creatinine
iii. hydrogen ions
iv. ammonia
v. penicillin

77. c. Name: loop of henle or loop of nephron

Characteristic 1: counter current mechanism - water reabsorption from the descending limb because to the hypertonic environment in renal medulla.

Characteristic 2: ascending limb is impermeable to water, only salt is actively and passively reabsorbed which adds to the hypertonic environment in medulla.

78. a. see # 68.

b. carrier proteins: active transport of substances - eg. active transport of penicillin during tubular secretion at the distal convoluted tubule.

peritubular capillary network: see above

sodium bicarbonate: reabsorbed into blood - buffer, when blood pH decreases.

aldosterone: see above

79. a. Structure X

Name: Renal Medulla
Description: hypertonic environment where water is reasorbed

Structure Y

Name: Renal Pelvis
Function: connects collecting ducts with ureter. Funnels urine out of kidney.

80. a. top left = glomerulus, bottom left = loop of henle, top right = distal convoluted tubule

81. a. Structure W: proximal convoluted tubule

Structure X: distal convoluted tubule

Structure Y: peritubular capillaries

Structure Z: loop of nephron/henle

for functions: see previous questions.

b. water gets reabsorbed from the nephron to the blood at the descending limb of the loop of nephron and the collecting duct.

P: Reproductive System

1. A	17. C	34. D	50. D	66. D	82. D
2. D	18. C	35. C	51. D	67. B	83. C
3. A	19. C	36. B	52. C	68. B	84. C
4. C	20. C	37. A	53. D	69. D	85. C check #s from here forward
5. D	21. B	38. A	54. D	70. C	86. B
6. C	22. C	39. D	55. D	71. D	87. C
7. B	23. B	40. A	56. C	72. D	88. B
8. B	24. A	41. C	57. D	73. B	89. C
9. A	25. B	42. D	58. B	74. C	90. D
10. B	26. A	43. D	59. C	75. D	91. C
11. D	27. C	44. B	60. C	76. A	92. C
12. D	28. C	45. C	61. A	77. A	93. B
13. A	29. D	46. D	62. B	78. A	94. B
14. B	31. B	47. B	63. C	79. A	95. C
15. C	32. B	48. D	64. D	80. C	96. A
16. A	33. A	49. B	65. D	81. D	97. A

98. testosterone: increase musculature and body hair

follicle-stimulating hormone: cause production and maturation of egg and sperm

luteinizing hormone: cause ovulation and development of the corpus luteum

estrogen: thickening of the endometrium, development of breasts, widening of the hips, storage of fat.

progesterone: cause the endometrium to become vascular and secretory - ready for zygote to implant

oxytocin: (positively) stimulate uterine contractions during onset of birth.

99. a. Estrogen: see above

LH (luteinizing hormone):

i. trigger ovulation
ii. formation of corpus lutuem and luteal cycle in ovary

b.

i. HGC is produced by the placenta to maintain the corpus luteum
ii. estrogen and progesterone levels increase

100. Testosterone:

i. increase musculature
ii. increase body hair
iii. voice change - larynx

Estrogen:

i. development of breasts
ii. widening of hips
iii. deposit of fat in thighs, hips, breasts.

Follicle stimulating hormone:

i. development of the follicle - egg.
ii. production of sperm by the seminiferous tubules

101. a.

i. corpus luteum develops in the ovary and produces higher levels progesterone
ii. endometrium becomes very thick, vascular and secretory, ready for zygote

b.

i. No FSH means that the follicle does not develop and there is no egg produced by the ovary. (this is how birth control pills work)

102. produces an egg: **ovary**

provides nourishment for the developing embryo: **endometrium**

enables the egg to travel to the uterus: **oviduct**

103. Structure X:

Name: uterus
Function: site of developing embryo

Structure Y:

Name: oviduct
Function: passageway for the egg to the oviduct (cilia and muscle contractions), site where fertilization takes place.

Structure Z:

Name: ovary
Function: produce egg, estrogen and progesterone

104. Structure X:

Name: ovary
Function: see above

Structure Y:

Name: uterus
Function: see above

Structure Z:

Name: vagina
Function: birth canal, houses the penis during intercourse

105. a. day 14

b. i. LH - Luteinizing Hormone

ii. anterior pituitary gland

c. development of the follicle and egg in the ovary, production of estrogen and thickening of the endometrium in the uterus.

106. left side = uterus, right top = oviduct, right middle =ovary, right bottom = vagina

107.

COMPONENT	FUNCTION
alkaline solution - bicarbonates	buffer acidic environment in vagina
prostaglandins	stimulate uterine contractions
fructose	provide energy
lubricating solution	help sperm motility

108a.

	HORMONE WHICH INITIAES PHASES	HORMONE PRODUCED BY OVARY
Phase 1 Days 1 to 14	Follicle Stimulating Hormone	Estrogen
Phase 2 Days 15 to 28	Luteinizing Hormone	Progesterone

b. i. Ovulation

ii. LH surge

c. corpus luteum degenerates and stops producing progesterone and estrogen

d. HCG (human chorionic gonadotropin)is produced by the developing placenta and causes the corpus luteum in the ovary to continue producing progesterone and estrogen.