BIOLOGY SAMPLE TEST

PART I.- Multiple choice questions (MCQ)-Select one correct answer and label it on the corresponding score sheet.

1. FSH and LH
A. are synthesized in the anterior pituitary.
B. are synthesized in the hypothalamus.
C. have negligible effects in male.
D. have negligible effects in female.
E. are stored in the posterior pituitary.

2. The velocity of blood flow is highest in
A. small arteries.
B. capillaries.
C. venules.
D. aorta.
E. arterioles.

3. What is the function of the saliva as a digestive fluid?
A. protein digestion
B. lipid digestion
C. nucleic acid digestion
D. carbohydrate digestion
E. vitamin digestion

4. What is the correct order of structures in the digestive system going from the mouth toward the anus?
A. pharynx, stomach, duodenum, esophagus
B. pharynx, esophagus, stomach, duodenum
C. stomach, duodenum, esophagus, pharynx
D. stomach, pharynx, esophagus, duodenum
E. stomach, pharynx, duodenum, esophagus

5. Choose the one FALSE statement. Hemoglobin
A. is composed of 4 globin chains
B. contains Fe^{2+} ions
C. is produced in the circulating red blood cells
D. binds O_2 reversibly
E. binds CO_2 reversibly

6. If 23 percent of the bases in a sample of double-stranded DNA are adenine, what percentage of the bases are guanine?
A. 0
B. 27
C. 73
D. 25
E. 50

7. The enzyme that restores the phosphodiester linkage between adjacent fragments in the lagging strand during DNA replication is

A. DNA ligase.
B. primase.
C. reverse transcriptase.
D. helicase.
E. DNA polymerase I.

8. In Mendel's peas, tall and short plant variants resulted from differences at a single genetic locus, with tall being dominant to short. The differences between the tall and short plants were caused by their different

A. alleles and gene pools.
B. gene pools.
C. alleles and genotypes.
D. alleles.
E. None of the above

9. Mitotic prophase differs from prophase I of meiosis in that

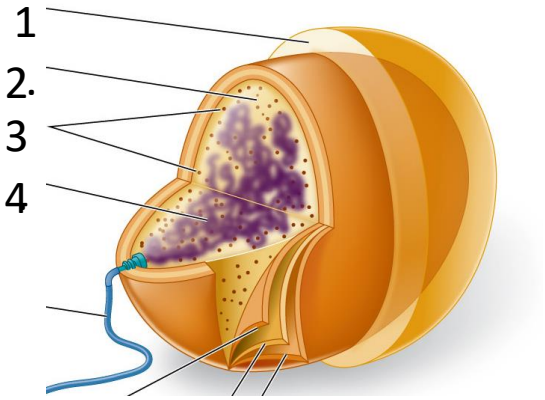
A. chromatin becomes supercoiled only in mitotic prophase.
B. the nuclear envelope disappears only in prophase I of meiosis.
C. synapsis occurs only in mitotic prophase.
D. the chromatids separate in mitotic prophase, not in prophase I of meiosis.
E. crossing over is characteristic of prophase I of meiosis but not of mitotic prophase.

10. Which compounds link glycolysis and the citric acid cycle to the electron transport chain?

A. NADH and ATP
B. ADP and P_i
C. $FADH_2$ and NADH
D. ATP and CO_2
E. Pyruvate and acetyl CoA

Section I.A Naming (5 points)

Please name what is shown on the figure below and the structures labeled by numbers, too!



1. _____ (1)
2. _____ (1)
3. _____ (1)
4. _____ (1)

The figure shows: _____(1)

Section I.B. Calculation (5 points)

Whether a pea seed is round or wrinkled is determined by a single gene called gene A, with round seeds being dominant to wrinkled seeds. In the progeny of a test cross, 900 seeds were collected. How many should be round out of the 900 seeds, if the unknown round-seeded plant being tested is heterozygous. Please give the genotypes of the testcross and genotypes of the progeny, too!

Genotypes of the testcross: _____ and _____ (1)

Genotypes of the progeny of the testcross:_____(1)

Since _____of the testcross progeny has _____ genotype, _____round

seeds should be present among the 900 seeds. (3)

PART II: Multiple choice questions (MCQ)-Select one correct answer and label it on the corresponding score sheet.

11. Which statement is true?
A. Kaposi's sarcoma is characteristic to AIDS patients.
B. Anaemia perniciosa is characteristic to AIDS patients.
C. Hay fever is characteristic to AIDS patients.
D. Rheumatoid arthritis is characteristic to AIDS patients.
E. Diabetes mellitus is characteristic to AIDS patients.

12. Partial pressure
A. of oxygen is almost 100 mmHg in the systemic arteries, and about 40 mmHg in the systemic veins
B. of oxygen is about 40 mmHg in the systemic arteries, almost 100 mmHg in the systemic veins
C. of CO_2 is almost 100 mmHg in the systemic arteries, and about 40 mmHg in the systemic veins
D. of CO_2 is about 40 mmHg in the systemic arteries, almost 100 mmHg in the systemic veins
E. of oxygen is almost 100 mmHg in the pulmonary arteries, and about 40 mmHg in the pulmonary veins

13. Choose the one FALSE statement. Involved in the regulation of the breathing:
A. Pons
B. Medulla oblongata
C. Cervical spinal cord
D. Lumbar spinal cord
E. Carotid body

14. Choose the one FALSE statement. Which of the followings take place during the systole?
A. Contraction of the ventricles
B. Relaxation of the ventricles
C. Increase of the pressure in the left ventricle
D. Increase of the pressure in the aorta
E. Decrease of the left ventricular volume

15. Choose the one FALSE statement. Progesterone…
A. prepares uterus for pregnancy.
B. prepares mammary glands for lactation.
C. is a peptide hormon.
D. inhibits the secretion of LH.
E. increases the body temperature.

16. Which protein is *not* part of the structure of a cilium?
A. α-tubulin
B. Keratin
C. Nexin
D. Dynein
E. β-tubulin

17. The statement "enzymes are highly specific" means that specific
A. enzymes are found in specific cells
B. enzymes require specific concentrations of substrates.
C. reactions with specific activation energies are catalyzed by specific enzymes.
D. reactions involving specific substrates are catalyzed by specific enzymes.
E. concentrations of substrates work with specific enzymes.

18. The conversion of malate to oxaloacetate in the citric acid cycle takes place with the conversion of NAD^+ to NADH. In this reaction, NAD^+ is a(n)
A. reducing agent.
B. oxidizing agent.
C. allosteric inhibitor.
D. allosteric activator.
E. feedback inhibitor.

19. Which of the following provides the correct order of events in the synthesis of the lagging strand?
A. Primase adds RNA primer, DNA polymerase III creates a segment of new DNA, DNA polymerase I removes the primer, and ligase seals the gaps.
B. Primase adds primer, DNA polymerase I removes the primer, DNA polymerase III extends the segment, and ligase seals the gap.
C. Ligase adds bases to the primase, the primase generates polymerase I, polymerase III adds to the segment of new DNA, and helicase winds the DNA.
D. Helicase unwinds the DNA, primase creates a primer, DNA polymerase I elongates the segment of new DNA, DNA polymerase III removes the primer, and ligase seals the gaps in the DNA.
E. None of the above

20. A codon is _____ nucleotides long, and there are _____ different possible codons in total.
A. 2; 16
B. 3; 64
C. 2; 64
D. 4; 64
E. 3; 16

Section II.A.

II. A. 1. Calculation (5 points).

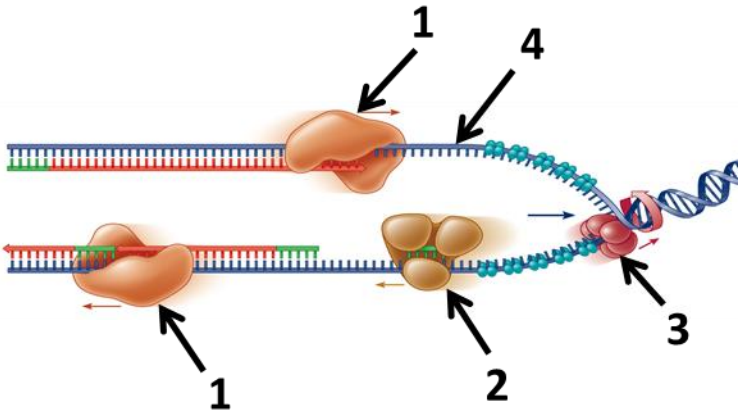
The scientists determined the mean diameter of muscle fibres in trained mice using an optical microscope to examine sections of muscle tissue. The circular area of one field of view was 1.25 mm^2. The diameter of this area was equal to the diameter of 15 muscle fibres.

Using this information, calculate the mean diameter in μm (micrometres) of muscle fibres in this section of tissue.

Answer= _____μm

II.A.2.Describe (5 points):

Please describe characteristics of the process shown on the figure below.



The figure represents _____. (1)

The aim of the process is to _____. (1)

The major enzyme required for the process is the _____ . (1)

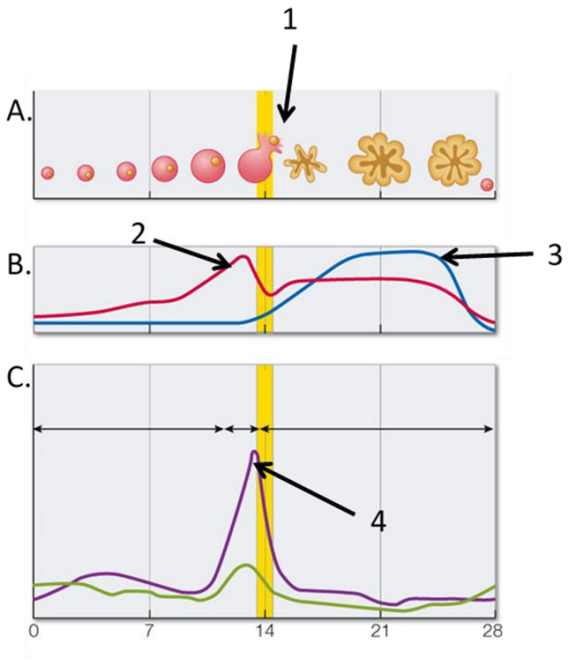
The _____ strand is labeled by 4. (1)

The function of the enzyme labeled by 2 is is to synthesize the _____. (1)

Section II. B.

II.B.1.Problem solving (one graph and multiple questions about that) (7)

The figure shows events and regulators of the female ovarian cycle.



(A) The process shown progresses from the development of _____ to _____ _____ and then to growth and finally to degeneration of the _____. (3)

The event labeled by **1**. is the _____. (1)

(B) Part B shows levels of hormones that stimulate the development of the endometrium in preparation for pregnancy. Hormone **2** is _____ and hormone **3** is _____ _____. (2)

(C) The hormone labeled by **4** is _____. (1)

II.B.2. Problem solving. The table shows three statements about some biological molecules. Fill the table by T (TRUE) and F (FALSE) signs appropriately. (3)

Statement	Facilitated transport	Active transport
Transport through instrinsic membrane		
Requires ATP		
From high to low concentration		

PART I

Multiple choice questions (MCQ)-Select one correct answer and label it on the corresponding score sheet.

1. Choose the correct statement about the element: $^{23}_{11}Na$
   A. An atom of the element contains 12 electrons.
   B. The atomic number of the element is 23.
   C. The mass number of the element is 11.
   D. The element is placed in the first period of the periodic table.
   E. An atom of the element contains 12 neutrons.

2. Which line shows the following atoms in order of decreasing atomic radius?

$$_6C\ ,\ _{15}P\ ,\ _7N$$

   A. N > C > P
   B. P > N > C
   C. P > C > N
   D. N > P > C
   E. C > N > P

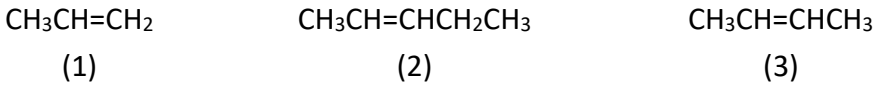
3. What is the oxidation number for sulfur in H_2SO_4?
   A. -4
   B. +3
   C. +4
   D. -6
   E. +6

4. Which statement is true for iodine?
   A. it is the most reactive halogen
   B. it consists of nonpolar, diatomic molecules
   C. it is a liquid at room temperature
   D. it has higher electronegativity than bromine
   E. it is not soluble in water at all

5. Two elements chemically combined defines:
   A. a homogeneous mixture
   B. a heterogeneous mixture
   C. a solution
   D. a compound
   E. none of these

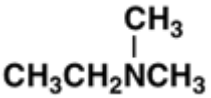
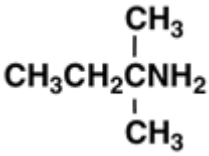
6. Solubility of nitrogen in water decreases upon:
   A. increasing the pressure
   B. increasing the temperature
   C. increasing the volume of the solvent
   D. all of them are correct
   E. none of them are correct

7. For which of the compounds below are *cis-trans* isomers possible?

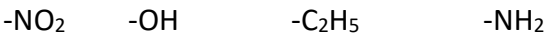


   A. only 2
   B. both 1 and 2
   C. both 2 and 3
   D. all three
   E. only 3

8. Which compound is a tertiary amine?

A.	B.	C.	D.	E.
$(CH_3)_3CNH_2$			$(CH_3CH_2)_2NH$	$(CH_3)\ NH_3^+$

9. The name of the following groups are:

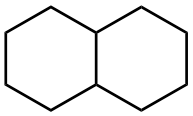


   A. nitro, aldehyde, ethyl, cyano
   B. nitro, hydroxyl, ethyl, amino
   C. amino, hydroxyl, benzyl, nitro
   D. cyano, oxo, methyl, amino
   E. amino, aldehyde, ethyl, nitro

10. The reaction type characteristic for alkanes is:
   A. addition
   B. substitution
   C. decarboxylation
   D. isomerization
   E. polymerization

Section I.A

1. Fill in the following table. **(5)**

Name of the compound		nitrous acid		ethanal	formic acid
Structure of the compound	$AlCl_3$				

Section I.B

1. Carry out the following conversions: **(2)**

5×10^{11} mg =…… Mg

0.008 cm^3 = ……. mm^3

2. Match each of the following chemical terms with the **BEST** definition chosen from the given pool. **(3)**

A. unsaturated compound ……

B. condensation ……

C. reducing agent ……

a. a compound that contains only carbon and hydrogen
b. a compound that contains only carbon and hydrogen, and has only single bonds
c. the conversion of a liquid to a solid
d. a substance that causes a reduction by donating an electron
e. the direct conversion of a gas to a solid
f. an organic molecule that contains a double or triple bond
g. the conversion of a gas to a liquid
h. a substance that causes a reduction by accepting an electron
i. a substance that is reduced by accepting an electron

PART II

Multiple choice questions (MCQ)-Select one correct answer and label it on the corresponding score sheet.

11. Give the expected ground-state electron configuration for the ion: $^{32}_{16}S^{2-}$.
    A. $1s^2 2s^2 2p^6 3s^2 3p^4$
    B. $1s^2 2s^2 2p^6 3s^2 3p^6$
    C. $1s^2 2s^2 2p^6 3s^1 3p^6$
    D. $1s^2 2s^2 2p^4 3s^2 3p^6$
    E. $1s^2 2s^2 2p^6 3s^3 3p^3$

12. What shape would you expect for SO_4^{2-} ion?
    A. trigonal planar
    B. trigonal pyramidal
    C. square planar
    D. linear
    E. tetrahedral

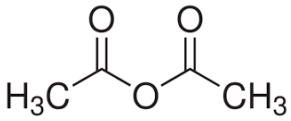
13. Which of the following substances is NOT able to form hydrogen bonds?
    A. H_2O
    B. glucose
    C. NH_3
    D. HBr
    E. $(CH_3)_2NH$

14. Choose the correct statement.
    A. Increasing number of covalent bonds between two atoms results in decreasing bond lengths.
    B. Covalent bonding is an attraction between oppositely charged ions.
    C. Nonpolar covalent bonds are formed when electrons are not shared equally.
    D. Water is a polar molecule because hydrogen is more electronegative than oxygen.
    E. When the electronegativity difference between two atoms is close to zero, the bond is polar.

5. Which of the following statements is true for the dissociation of a strong acid (HA) in water?
    A. Strong acids in aqueous solution dissociate almost entirely to A^- ions.
    B. The pH of strong acids is close to 14.
    C. At equilibrium $[A^-] << [HA]$.
    D. The percent dissociation of strong acids is low.
    E. At equilibrium $[A^-] << [H^+]$

16. The heat of formation of an element is:
    A. infinite
    B. zero
    C. always negative
    D. always positive
    E. either positive or negative

17. The molecule presented by the picture on the right is called:
    A. acetoacetate
    B. acetic anhydride
    C. ethylacetate
    D. dimethylester
    E. dimethylether



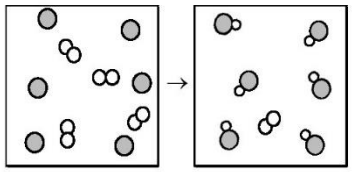
18. Which of the followings is an aromatic compound?
    A. decaline
    B. cyclohexene
    C. pyrrole
    D. tetrahydrofuran
    E. quinone

19. The following pairs of molecules represent:
    A. stereoisomers
    B. constitutional isomers
    C. enantiomers
    D. *cis-trans* isomers
    E. functional group isomers

20. Choose the one with the highest boiling point.
    A. CH_3-OH
    B. CH_3-CH_2-OH
    C. CH_3-CH_3
    D. CH_3-CH_2-CH_3
    E. CH_3-CH=CH_2

Section II.A.

1. The following diagram represents the reaction of A_2 (unshaded spheres) with B (shaded spheres). **(3)**



1p each

1.a. Write a balanced equation for the reaction.

2.b. Identify the limiting reactant.

2.c. How many moles of product can be produced from the reaction of 1.0 mol of A_2 and 1.0 mol of B?

2. Oxygen gas is commonly sold in 40.0 L steel containers at 19.5 ^oC and at a pressure of 124 atm. **(5)**

2.a. What volume in liters would the gas occupy at a pressure of 1.09 atm if its temperature remained unchanged?

2.b. What is the volume of the gas if its temperature was raised from 19.5 °C to 37.5 °C at constant pressure of 124 atm?

3. Write reaction equation for the Brønsted-Lowry acid-base reaction between ammonia and hydrochloric acid. Identify the conjugate acid-base pairs. **(2)**

Section II. B.

1. Draw structures and appropriate names to illustrate **(6)**

1.a. geometrical isomer pair of the unsaturated compound with molecular formula C_4H_8

1.b. enantiomers of lactic acid

1.c. keto-enol tautomers of acetone

2. Fill in the gaps in the following sentences. **(4)**

Molecules of primary and secondary amines can form…….. to each other, while tertiary amines cannot. For that reason, …… amines have the lowest boiling points among isomeric amines.

In aqueous solution aliphatic amines act as Brønsted-Lowry ……. .

Aldehydes and ketones react with primary amines to yield …… .