

UNIVERSITY OF BOLTON

**SCHOOL OF CLINICAL AND BIOMEDICAL
SCIENCES**

BSc (Hons) MEDICAL BIOLOGY WITH FOUNDATION

SEMESTER TWO EXAMINATIONS 2021/22

PRINCIPLES OF BIOMOLECULAR SCIENCE

MODULE NO: BIO3025

Date: Monday 16th May 2022

Time: 10:00 – 12:00

INSTRUCTIONS TO CANDIDATES:

Candidates are advised that the examiners attach importance to legibility of writing and clarity of expression. **YOU ARE STRONGLY ADVISED TO PLAN YOUR ANSWERS**

There are **TWO** sections.

Answer **ALL** questions from Section A and Section B.

Write all answers in answer booklet.

Marks for parts of questions are shown in brackets.

This examination paper carries a total of 80 marks.

Calculators are permitted, but all working must be shown.

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SECTION A: Answer ALL questions in this section; 1 mark per question, 40 marks in total. It is recommended you spend 50 minutes on this section.

1. Atoms are made up of...
 - a. Protons
 - b. Neutrons
 - c. Electrons
 - d. All of the above

2. What is the mass number of an element?
 - a. The total number of protons in the nucleus
 - b. The total number of electrons in the nucleus
 - c. The total number of electrons and protons in the nucleus
 - d. The total number of protons and neutrons in the nucleus

3. The element $^{32}_{16}\text{S}^{2-}$ has...
 - a. Gained two protons
 - b. Lost two electrons
 - c. Gained two electrons
 - d. An atomic number of 32

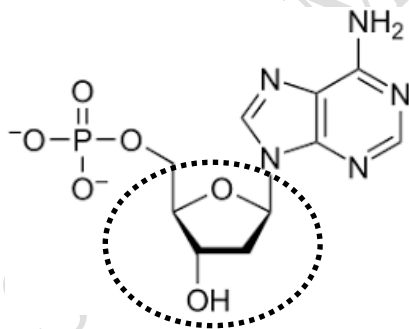
4. A hydrophobic molecule tries to avoid what?
 - a. High temperatures
 - b. Freezing temperatures
 - c. Interacting with other molecules
 - d. Water

5. One mole of any substance contains 6.022×10^{23} molecules; this is known as what?
 - a. Avogadro's Constant
 - b. The atomic number
 - c. Newton's second law
 - d. The concentration

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6. If 5 moles of NaCl is dissolved in 500 mL of water, what is the concentration of the resulting solution?
- 0.010 M.
 - 10 M.
 - 2 M.
 - 4 M.
7. Which of the following organelles is **NOT** found in an animal cell?
- A nucleus
 - A mitochondrion
 - A chloroplast
 - A ribosome
8. The ribosome has what function in the cell?
- It is the site of protein synthesis
 - It is the site of DNA replication
 - It is the site of RNA synthesis
 - It is responsible for the tertiary structure of proteins
9. A nucleotide has the following structure:



What component of a nucleotide has been circled?

- The phosphate group
- The sugar molecule
- The base group
- The uracil

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10. DNA is copied via semi-conservative replication. What does this mean?
- Newly synthesised DNA is made up of two molecules of parent DNA
 - Newly synthesised DNA is made up of completely new daughter strands of DNA
 - Newly synthesised DNA is made up of one parent strand and a newly synthesised daughter strand of DNA
 - DNA is transcribed into RNA
11. In a eukaryotic cell, DNA is stored in which structure?
- The ribosome
 - The endoplasmic reticulum
 - The Golgi apparatus
 - The nucleus
12. Which of the following is a bond found in a molecule of DNA?
- Peptide bond
 - Phosphodiester bond
 - Acyl bond
 - Ester bond
13. Transcription uses which molecule as a template for RNA synthesis?
- DNA
 - RNA
 - Protein
 - Chromatin
14. Which of the following RNA sequences is made from the DNA sequence 5' ATGCGGATCAA 3'
- UACGCCUAGUU
 - TACGCCTAGTT
 - AUGCGGAUCAA
 - UUGAUCCGUT
15. The formation of a peptide bond occurs between which two groups found in an amino acid?
- The R-group of two amino acids
 - The carboxyl group of one amino acid and the amino group of another
 - The carboxyl group of one amino acid and the R-group of another

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- d. The amino group of one amino acid and the R-group of another

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16. Which level of protein structure consists of 2 or more polypeptides?
- Primary structure
 - Secondary structure
 - Tertiary structure
 - Quaternary structure
17. Haemoglobin is an example of what type of protein?
- A fibrous protein
 - A membrane protein
 - A globular protein
 - None of the above
18. Which of the following best describes a lipid?
- A group of organic compounds that do not interact well with water
 - A group of inorganic compounds that interact well with water
 - A group of organic compounds that interact well with water
 - A group of inorganic compounds that do not interact well with water
19. What distinguishes an unsaturated fatty acid from a saturated fatty acid?
- They are longer
 - They are shorter
 - They have a double bond
 - They have more carbons
20. Glycogen is an example of?
- A monosaccharide
 - A disaccharide
 - A polysaccharide
 - A glycoprotein
21. Which organ of the human body is the main store for glycogen?
- The brain
 - The heart
 - The liver
 - The pancreas

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22. The net production of ATP molecules by the glycolysis cycle is?
- 1 ATP
 - 32 ATP
 - 2 ATP
 - 4 ATP
23. Enzymes speed up a reaction without _____.
- Being used up
 - Being involved
 - Using energy
 - A substrate
24. Which of these factors best describes a thermophilic enzyme?
- Works best at high a temperature
 - Works best at low a pH
 - Works best at low a temperature
 - Works best at high a pH
25. Some drugs act as enzyme inhibitors. How does penicillin act as an antibiotic against bacterial cells?
- Weakens the cell wall by inhibiting the transpeptidase enzymes
 - Binds to the ribosome to prevent protein production
 - Blocks enzymes in certain metabolic pathways of the bacterial cell
 - Punches holes in the outer membrane
26. Which of the following best describes osmosis?
- The movement of gases from an area of high to low concentration
 - The movement of ions from an area of low to high concentration
 - The movement of water through an impermeable membrane
 - The movement of water from an area high to low concentration
27. Which of the following best describes endocytosis?
- Taking molecules into the cell in vesicles
 - The secretion of cellular molecules by vesicles

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- c. Digestion of waste products by vesicles
- d. Budding of vesicles from the Golgi apparatus

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28. **Glucose + Oxygen ---> _____ + Water + (ATP + Heat)**

The above equation represents the process of cellular respiration. Fill in the missing component:

- a. Glycogen
- b. Carbon monoxide
- c. Nitrogen
- d. Carbon dioxide

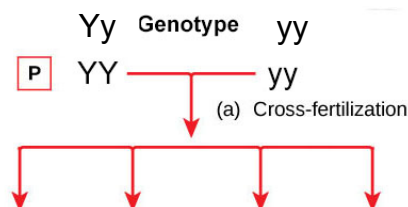
29. Which of the following is **NOT** a stage of cellular respiration?

- a. Gluconeogenesis
- b. Glycolysis
- c. The Krebs cycle (TCA cycle)
- d. The electron transport chain

30. What best describes a homozygous dominant gene?

- a. aa
- b. Aa
- c. XY
- d. AA

31. The following diagram shows a parental (P) genetic cross of yellow (dominant) and white (recessive) roses:



What ratio of yellow to white roses would you expect in the F1 generation?

- a. 1:1
- b. 3:1
- c. 2:1
- d. 4:0

PLEASE TURN THE PAGE....

32. Charles Darwin and _____ co-founded the Theory of Evolution:
- Gregor Mendel
 - Isaac Newton
 - Alfred Russel Wallace
 - Marie Curie
33. What is an allele?
- A variant of a protein
 - A gene with two identical sequences
 - A variation of the same gene
 - The coding region of a gene
34. A species is defined as:
- A group of different organisms capable of producing fertile offspring
 - A group of similar organisms producing infertile offspring
 - A group of similar organisms found in the same place
 - A group of similar organisms capable of producing fertile offspring
35. Which of the following is **NOT** a key characteristic of a model organism?
- Long life cycles
 - Easy to cross/breed
 - Characterised genomic sequence
 - Large numbers of offspring
36. Which of the following is **NOT** a phase in Mitosis?
- Telophase
 - Interphase
 - Prometaphase
 - Metaphase
37. At the end of Meiosis, how many chromosomes are present in each the four daughter cells compared to the parental cell?

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- a. Double
- b. Triple
- c. Quadruple
- d. Half

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38. In cell signalling, which of the following statements about endocrine signalling is **TRUE**?

- a. Occurs over long distances
- b. Occurs by direct contact between cells
- c. Does not involve receptors
- d. Does not involve hormones

39. Which of the following is **NOT** an antibody class?

- a. IgG
- b. IgA
- c. IgU
- d. IgM

40. Which of the following is the site of photosynthesis in plant cells?

- a. Mitochondria
- b. Ribosome
- c. Chloroplast
- d. Nucleus

Total for Section A: 40 marks

END OF SECTION A

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SECTION B: Answer ALL questions in this section; 40 marks in total. It is recommended that you spend 1 hour and 10 minutes on this section.

- 1) This question is about Sodium Chloride [NaCl] (MW: 58)
- a) How many grams of NaCl would be required to make 0.5 litres of a 1M solution? **[2 marks]**
- b) What is the concentration of a solution with a volume of 2 litres containing 120 grams of NaCl? [2] (moles=mass/Mr) **[2 marks]**
- c) Using the concentration calculated in question 1b, what would the concentration be if 3 litres of water were to be added to make a final volume of 5 litres? **[3 marks]**
- d) How much water would you need to add if you were to dilute Solution 1c to a final concentration of 0.25M? **[3 marks]**

Total: 10 marks

- 2) A biologist crosses two pea plants with one another. One has purple flowers. One has white flowers.
- The purple flower is heterozygous.
 - Purple flower colour is dominant to white.
- Draw a punnet square to represent the F1 generation. Clearly state the genotype of both parent plants and the ratio of phenotypes found in the F1 generation.

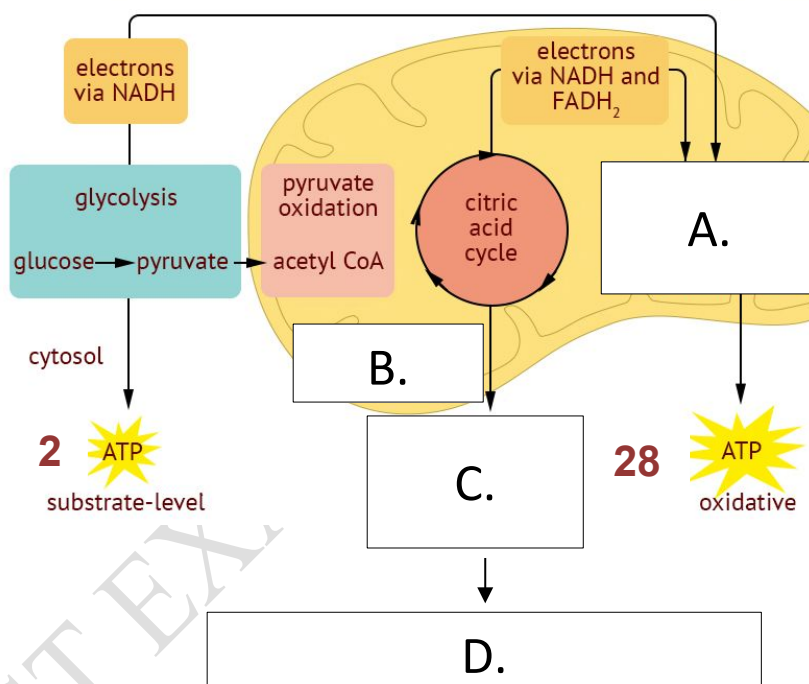
[5 marks]

- 3) Describe how the environment can influence evolution. In particular, discuss stabilizing, directional and diversifying selection.

[5 marks]

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- 4) The following diagram outlines several processes linked to cellular respiration. Answer the questions that follow:



- Name one molecule, aside from a carbohydrate, can be used to generate glucose?
- What is the final process labelled A?
- What is the organelle labelled B, where process A is carried out?
- How many molecules of ATP is/are produced from the citric acid cycle (Krebs cycle)?
- What is the total number of ATP molecules produced from cellular respiration?

Total 5 marks

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4. The process of transcription synthesizes RNA from a DNA template. Name the 3 types of RNA found in cells and explain the differences between them.

[5 marks]

5. State and briefly describe the phases of Mitosis.

[5 marks]

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6. What is the difference between innate immunity and acquired immunity? In your answer, give clear examples of both.

[5 marks]

Total for Section B: 40 marks

END OF PAPER

PAST EXAMINATION PAPER