Module Code: BIO00018C

Examination Candidate Number: __________
Desk Number: __________

BSc Degree Examinations 2018-9

Department:
BIOLOGY

Title of Exam:
Introduction to Biomedical Sciences I

Time Allowed:
1 hour 30 minutes

Marking Scheme:
Total marks available for this paper: 50
The marks available for each question are indicated on the paper

Instructions:
Answer all questions in the spaces provided on the examination paper

Materials Supplied:
CALCULATOR

For marker use only: Office use
only:

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DO NOT WRITE ON THIS BOOKLET BEFORE THE EXAM BEGINS
DO NOT TURN OVER THIS PAGE UNTIL INSTRUCTED TO DO SO BY AN INVIGILATOR
1. Define the term ‘emerging infectious disease’. (1 mark)

2. Explain the difference between zoonoses and vector-borne diseases. Provide an example for each type of disease. (3 marks)

3. List 3 mechanisms for how antibiotics can target bacterial cells. (3 marks)
4. Study the data in Table 1:

Table 1: Years of Life Lost (YLL) and Years Lost to Disability (YLD) for people living with, or the consequences of, Myocardial Infarction and Diabetes in the UK in 2017.

<table>
<thead>
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<th>Cause</th>
<th>YLL (000’s)</th>
<th>YLD (000’s)</th>
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<tbody>
<tr>
<td>Myocardial Infarction</td>
<td>1,342</td>
<td>122</td>
</tr>
<tr>
<td>Diabetes</td>
<td>80</td>
<td>652</td>
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a) Describe the differences in YLL and YLD between the two diseases and suggest a reason for these differences. (2 marks)

b) Calculate the Disability-adjusted life years (DALYs) for Myocardial Infarction and Diabetes. (1 mark)

5. Describe the main structural and functional features of a gomphosis joint. Where in the body would you find this joint? (3 marks)
6. a) A study was conducted to determine the impact of creatine on skeletal muscle performance. Using the data in the figure below, describe the effect that creatine has on muscle contraction force and suggest a possible explanation for these findings.

(4 marks)

Figure 1: (A) The effect of creatine on contraction force from isolated mouse extensor digitorum longus (EDL) muscle fibres during fatigue and recovery periods. Data represent electromyograph (EMG) force tracings from a muscle fibre during a single twitch and 100-Hz tetanus. (B) Intracellular calcium concentration from isolated EDL muscle fibres (n = 6) during fatigue and recovery. Data represent mean values ± s.e.m * indicates a significant difference (p < 0.05).
b) Explain the role of tropomyosin in the thin-filament in cross-bridge formation.

(3 marks)

7. Blood glucose measurements were recorded using a glucometer at the indicated times following the ingestion of a drink containing 50 g glucose. The subject was fasted prior to the experiment.

Figure 2: Blood glucose measurements were recorded using a glucometer at the indicated times following the ingestion of a drink containing 50 g glucose. The subject was fasted prior to the experiment.

a) Draw a second curve on the graph in Figure 2 to represent the blood glucose response of a Type I diabetic who has ingested the same glucose drink. Justify the features of your curve in terms of physiological mechanisms. 

(5 marks)
b) Why are Type I diabetics more at risk for conditions such as heart disease, stroke, high blood pressure, blindness and nerve damage? (2 marks)

8.

a) Why does dietary iodine concentrate in the thyroid gland? (2 marks)

b) Describe the general effects of hyperthyroidism on the body. (2 marks)

The space above the line should be sufficient for your answer.
9. Describe how the high solute concentration in the interstitial fluid of the inner medulla of the kidney is generated.  

(7 marks)


a) What breathing instructions does the doctor need to give the patient to obtain FEV1 (Forced Expiratory Volume at 1 Second) and FVC (Forced Vital Capacity)?

(2 marks)

The space above the line should be sufficient for your answer.
The doctor compares the measured FEV1 and FVC with the predicted values:

\[
\text{Measured: } \text{FEV1} = 2 \text{ litres}, \text{ FVC} = 4 \text{ litres} \\
\text{Predicted: } \text{FEV1} = 4 \text{ litres}, \text{ FVC} = 5 \text{ litres}
\]

b) What type of chronic lung disease might the patient suffer from? Explain how you have reached your conclusion. (5 marks)

The space above the line should be sufficient for your answer.
11. Based on the data in the figure below, and your understanding from the lectures, describe the mechanism by which Salbutamol regulates contractile responses in the trachea. (5 marks)

**Figure 3:** (A) Tracheal rings were isolated from mice and pre-contracted with methacholine (1 µM; MCh). Changes in contractile force were then measured in response to increasing concentration of Salbutamol in the absence (Salbutamol alone) or presence of the cAMP inhibitor, 8-pCPT-2'-O-Me-cAMP (100 µM; Salbutamol + 8-pCPT-2'-O-Me-cAMP). Data points represent mean ± s.e.m (n = 4). ** indicates p-value < 0.01 between treatment groups. (B) The extent of myosin light chain (MLC) phosphorylation was determined in tracheal rings under different treatment conditions as indicated in table below chart (+ corresponds to presence of treatment; - corresponds to absence of treatment). Bars represent mean ± s.e.m (n = 4). *** indicates p-value < 0.001 between treatment groups (only statistics required for answer are provided).