Level 3 Certificate / Extended Certificate
APPLIED SCIENCE
Unit 4 The Human Body

Tuesday 22 May 2018 Morning Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
• a calculator.

Instructions
• Use black ink or black ball-point pen.
• Answer all questions.
• You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
• Do all rough work in this book. Cross through any work you do not want to be marked.

Information
• The marks for questions are shown in brackets.
• The maximum mark for this paper is 60.

Advice
Read each question carefully.
Answer all questions.

01 A man has diarrhoea and goes to see the doctor. The doctor diagnoses irritable bowel syndrome (IBS). IBS can reduce absorption of some nutrients into the blood. Figure 1 shows the digestive system.

**Figure 1**

![Digestive System Diagram]

01.1 Name the part of the digestive system which is affected by IBS.

Label this part X on **Figure 1**.

Name of part ____________________________ [2 marks]

01.2 The man’s symptoms are worse after eating fatty foods.

Parts A and B in **Figure 1** are involved in the digestion of fats.

Name parts A and B.

A ____________________________ [2 marks]

B ____________________________
Explain how part A helps speed up the digestion of fats. [3 marks]

Lipase is a type of enzyme that digests fats.

Complete Table 1 for carbohydrase and protease.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Carbohydrase</th>
<th>Lipase</th>
<th>Protease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enzyme substrate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One place in the body where the enzyme is made</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One place in the body where the enzyme acts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fats</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>small intestine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>small intestine</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
01.5 Vitamins are an essential part of a healthy diet.

What is the name of the deficiency disease caused by vitamin C deficiency?

[1 mark]

01.6 Give two symptoms of vitamin C deficiency.

[2 marks]

1

2

01.7 Suggest two ways in which vitamin C deficiency can be treated.

[2 marks]

1

2
Table 2 shows data from hospital admissions in the UK.

Table 2

<table>
<thead>
<tr>
<th>Year</th>
<th>Total number of adults and children admitted to hospital with vitamin C deficiency</th>
<th>Number of children admitted to hospital with vitamin C deficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>2014</td>
<td>137</td>
<td>10</td>
</tr>
<tr>
<td>2016</td>
<td>237</td>
<td>48</td>
</tr>
</tbody>
</table>

Calculate the percentage increase in cases of vitamin C deficiency from 2010 to 2016.

Use information from Table 2.

[2 marks]

Percentage increase = __________________________

A newspaper makes the following statement:

Malnutrition in children is on the rise in the UK.

Give one reason that supports the newspaper’s statement and one reason that does not support the newspaper’s statement.

[2 marks]
Neurologists study the brain and its functions to diagnose disorders.

**Figure 2** shows the lobes of the brain.

### Figure 2

- **Frontal lobe**
- **Parietal lobe**
- **Occipital lobe**
- **Temporal lobe**

**02.1** Draw one line from each lobe of the brain to the function of the lobe. [4 marks]

<table>
<thead>
<tr>
<th>Lobe of the brain</th>
<th>Function of the lobe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontal</td>
<td>emotions and reasoning</td>
</tr>
<tr>
<td>Occipital</td>
<td>memory and speech</td>
</tr>
<tr>
<td>Parietal</td>
<td>movement and recognition</td>
</tr>
<tr>
<td>Temporal</td>
<td>posture and balance</td>
</tr>
<tr>
<td></td>
<td>visual processing</td>
</tr>
</tbody>
</table>
Where in the brain are the lobes in Question 02.1 found?

Tick (√) one box. [1 mark]

Brain stem

Cerebellum

Cerebral cortex

When a person is frightened their heart rate increases and their pupils dilate.

Which part of the nervous system causes these symptoms?

Tick (√) one box. [1 mark]

Parasympathetic

Peripheral

Somatic

Sympathetic

Question 2 continues on the next page
Alzheimer’s disease affects different parts of the brain.

Give three symptoms of Alzheimer’s disease.

[3 marks]

1. 

2. 

3. 

People with Alzheimer’s disease do not produce enough acetylcholine in their brain.

Acetylcholine is a neurotransmitter used in synapses.

Describe the sequence of events that allows an impulse to pass from one neurone to the next neurone at the synapse.

[3 marks]
An elderly woman falls and injures herself. She is taken to hospital to have an X-ray. **Figure 3** shows the X-ray.

**Figure 3** shows the X-ray.

The X-ray shows that the woman has had a joint replaced.

What type of joint has been replaced? Tick (✓) one box.

- Ball and socket
- Gliding
- Hinge
- Pivot

What range of movement does joint C in **Figure 3** have?

---

Question 3 continues on the next page
Figure 4 shows some parts of the synovial joint in a knee.

Figure 4

0 3 3 Name parts P and Q in Figure 4. [2 marks]

P ____________________________

Q ____________________________

0 3 4 What is the role of part R in Figure 4? [1 mark]

__________________________________________________________________________

__________________________________________________________________________
Some people need to have knee replacement surgery.

**Figure 5** shows a traditional artificial knee joint.

**Figure 6** shows an artificial knee joint made using 3D printing technology.

![Diagram of knee joints](image)

**03.5** What is the function of the plastic between the metal alloy and the bone? [1 mark]


**03.6** The knee in **Figure 6** has been made for a specific patient using a 3D printer.

Suggest one advantage of the knee joint in **Figure 6** compared with the knee joint in **Figure 5**. [1 mark]


Sports science students were investigating the effect of fatigue on fast-twitch muscle fibres and slow-twitch muscle fibres.

Give two adaptations of slow-twitch muscle fibres. [2 marks]

1

2

In the investigation, the students used muscle fibres from rats. Using data loggers the students measured the force produced by each muscle contraction until the force declined to 50% of the original.

Table 3 shows some of their results.

<table>
<thead>
<tr>
<th>Time / ms</th>
<th>Force of muscle contraction as a percentage of the original force</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Slow-twitch leg muscle fibre</td>
</tr>
<tr>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>92</td>
</tr>
<tr>
<td>12</td>
<td>91</td>
</tr>
<tr>
<td>18</td>
<td>87</td>
</tr>
<tr>
<td>24</td>
<td>88</td>
</tr>
<tr>
<td>30</td>
<td>84</td>
</tr>
<tr>
<td>36</td>
<td>78</td>
</tr>
<tr>
<td>42</td>
<td>77</td>
</tr>
</tbody>
</table>
04.2 Complete the graph for the fast-twitch leg muscle fibre on Figure 7. [2 marks]

Figure 7

![Graph showing percentage force over time for fast-twitch leg muscle fibre compared to slow-twitch leg muscle fibre.]

Key
- - - - Fast-twitch leg muscle fibre
- --- Slow-twitch leg muscle fibre

04.3 Give two conclusions the sports science students could make from the data shown in Table 3 and Figure 7. [2 marks]

1

2

Question 4 continues on the next page
04.4 Explain why muscles become fatigued. Use knowledge of the sliding filament theory of muscle contraction in your answer. [2 marks]

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

04.5 Some athletes take creatine supplements. Explain why the force of a muscle contraction may be greater in someone taking creatine supplements. [3 marks]

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
Devic disease is a disorder that affects motor neurones. Figure 8 shows a motor neurone from a healthy person.

**Figure 8**

Name S, T and U in Figure 8. [3 marks]

S

T

U

Explain how part U enables nerve impulses to travel at high speed along the motor neurone in Figure 8. [3 marks]

Question 5 continues on the next page
Figure 9 shows changes in membrane potential of a neurone during one action potential.

Figure 9

Describe what happens to cause the change in membrane potential between point W and point X on Figure 9.

[2 marks]
At point Y the neurone is maintaining its resting potential.

Explain how the resting potential is maintained. [3 marks]

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END OF QUESTIONS
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