COMMON ENTRANCE EXAMINATION AT 13+

SCIENCE

BIOLOGY

Monday 23 January 2012

Please read this information before the examination starts.

- This examination is 40 minutes long.
- The answers should be written on the question paper.
- Answer all the questions.
- Calculators may be required.
1. Underline the option which best completes each of the following:

(a) In a cell, the genes are found in the
   cell membrane  cytoplasm  nucleus  vacuole

(b) In plants, the male sex cell is found in the
   ovule  petals  pollen grain  seed

(c) Potatoes are a good source of
   fat  carbohydrate  protein  vitamin D

(d) The reactants in respiration are
   carbon dioxide and oxygen  carbon dioxide and water
   glucose and oxygen  glucose and water

(e) To test for starch you would use
   a microscope  iodine solution  limewater  methylene blue

(f) In Britain in summer, the population of plants growing on the forest floor is likely to
   be smaller than in spring because of
   an unsuitable temperature  competition for food
   competition for light  predation

(g) A dolphin is not considered a fish because it
   can swim  gives birth to live young
   has a backbone  has fins

(h) Root hair cells are well adapted to absorbing water because they
   can move  have a large surface area
   have a nucleus  have no chloroplasts

(i) Drinking excessive amounts of alcohol causes most damage to the
   eyes  throat  liver  lungs
2. This question is about human reproduction.

(a) Four reproductive organs are listed below.
   Link each organ on the left to the most appropriate function on the right with a straight line.
   *(The first one has been done for you.)*

<table>
<thead>
<tr>
<th>reproductive organ</th>
<th>function</th>
</tr>
</thead>
<tbody>
<tr>
<td>uterus (womb)</td>
<td>usual site of fertilisation</td>
</tr>
<tr>
<td>testes</td>
<td>usual site of implantation of a fertilised egg</td>
</tr>
<tr>
<td>ovaries</td>
<td>production of sperm</td>
</tr>
<tr>
<td>oviduct (fallopian tube)</td>
<td>production of eggs</td>
</tr>
</tbody>
</table>

(b) A developing baby is surrounded by amniotic fluid inside the uterus.
   Give one reason why this fluid is important.

........................................................................................................................................... (1)

(c) The developing baby gets its nutrients from its mother’s blood.
   Name the organ in which the exchange of substances between the baby’s blood and the mother’s blood takes place.

........................................................................................................................................... (1)
3. Here is a typical food chain for a woodland in Britain:

   oak tree → caterpillars → blue tits

(a) Use the words in the box to fill in the spaces in the passage below. Each word may be used once, more than once or not at all.

<table>
<thead>
<tr>
<th>carnivores</th>
<th>energy</th>
<th>food web</th>
</tr>
</thead>
<tbody>
<tr>
<td>herbivores</td>
<td>photosynthesis</td>
<td>respiration</td>
</tr>
</tbody>
</table>

A food chain shows the flow of ......................... between living things. Producers, such as green plants, are found at the start of all food chains because they can produce their own ......................... For example, an oak tree produces sugar through ......................... Primary consumers or ......................... eat the producers. ......................... eat the primary consumers.

In reality, many food chains interlink to produce food webs.

(b) Identify a primary consumer and the top carnivore in the following food web:

```
sparrowhawk
   
blue tit ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← -
4. Below is a list of six of the essential food groups in a balanced diet.

<table>
<thead>
<tr>
<th>carbohydrate</th>
<th>fats</th>
<th>fibre</th>
</tr>
</thead>
<tbody>
<tr>
<td>minerals</td>
<td>vitamins</td>
<td>water</td>
</tr>
</tbody>
</table>

(a) One food group is missing from the table.

(i) Write down this missing food group.

........................................................................................................................................ (1)

(ii) Write down what this missing food group is used for in the body.

........................................................................................................................................ (1)

(iii) Name one food which is a good source of this missing food group.

........................................................................................................................................ (1)

(b) Plants store carbohydrate as starch.
Outline how you could test an oak leaf for starch in your laboratory.
(Remember to include any safety precautions which you would take.)

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........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................ (4)
5. The diagram below shows the positions of some major organs in the body.

(a) Identify organs A, B and C.

A: ..............................................................
B: ..............................................................
C: ..............................................................

(b) The lungs are also shown on the diagram.
They are part of the respiratory system.
Gas exchange takes place inside the lungs.
Write down two features which makes the lungs well adapted for gas exchange.

feature one: ..............................................................
feature two: ..............................................................

The table below shows the differences between air breathed in (inhaled air) and air breathed out (exhaled air).

<table>
<thead>
<tr>
<th>gas</th>
<th>% in inhaled air</th>
<th>% in exhaled air</th>
</tr>
</thead>
<tbody>
<tr>
<td>nitrogen</td>
<td>78.00</td>
<td>78.00</td>
</tr>
<tr>
<td>oxygen</td>
<td>21.00</td>
<td>16.05</td>
</tr>
<tr>
<td>carbon dioxide</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>other gases</td>
<td>0.95</td>
<td>0.95</td>
</tr>
</tbody>
</table>

(c) Complete the table to show the percentage of carbon dioxide in exhaled air.
Ben and Anna decide to check the differences in carbon dioxide levels between inhaled and exhaled air.

Using the mouthpiece, they each breathe in and out ten times through the equipment shown below.

The air they breathe in enters the apparatus through tube A and the air they breathe out leaves the apparatus through tube B.

![Diagram of apparatus with tubes A and B and limewater](image)

(d) The limewater in one of the tubes will go cloudy before the limewater in the other. Suggest in which tube, A or B, this will be and explain your answer.

**tube:** .................................................................

**explanation:** ..........................................................

................................................................. (2)

(e) The percentage of oxygen present in exhaled air is about 4–5% less than in inhaled air.

Explain carefully what happens to this oxygen after it is inhaled.

........................................................................

........................................................................

........................................................................

........................................................................

........................................................................ (4)
6. George investigated how carbon dioxide concentration affected the rate of photosynthesis in pondweed.

He used the increase in mass of pondweed as an indicator for the rate of photosynthesis.

A table of his results is shown below.

<table>
<thead>
<tr>
<th>concentration of carbon dioxide available to pondweed, in %</th>
<th>starting mass of pondweed, in g</th>
<th>final mass of pondweed, in g</th>
<th>increase in mass, in g</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2.00</td>
<td>2.00</td>
<td>0.00</td>
</tr>
<tr>
<td>0.5</td>
<td>2.00</td>
<td>2.20</td>
<td>0.20</td>
</tr>
<tr>
<td>1</td>
<td>2.00</td>
<td>2.40</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>2.00</td>
<td>2.50</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2.00</td>
<td>2.55</td>
<td>0.55</td>
</tr>
</tbody>
</table>

(a) Write the word equation for photosynthesis below. (2)

\[
\text{chlorophyll} + \text{ } \rightarrow \text{ } + \text{sunlight}
\]

(b) Complete the table above by calculating the increase in mass for the 1% and 1.5% carbon dioxide concentrations. (2)
(c) Using the instructions below, plot a line graph of George’s results to show how the increase in mass of pondweed changes with carbon dioxide concentration.

instruction 1: add sensible number scales to each axis (2)  

instruction 2: carefully plot the five points on the graph to show the increase in mass of the pondweed at the five different carbon dioxide concentrations (2)  

instruction 3: draw a smooth curve of best fit through the data points (1)

(d) Using your graph, describe the relationship between carbon dioxide concentration and the increase in mass of the pondweed.

........................................................................................................................................ (2)

(e) Give one way in which George could have improved the reliability of his investigation.

........................................................................................................................................ (1)
7. The picture below shows a honey bee.

Honey bees are insects and extremely important pollinators of many food plants, including broccoli, cauliflower and apple.

Without honey bees, some of these plants would not be able to reproduce.

Over the last few years, the population size of honey bees has decreased significantly.

(a) Give two features of insects.

feature 1: .............................................................................................................. (1)

feature 2: .............................................................................................................. (1)

(b) Suggest two possible reasons why the honey bee population has decreased recently.

reason 1: .............................................................................................................. (1)

reason 2: .............................................................................................................. (1)

Research needs to be done to find ways in which we can help to increase the size of the honey bee population.

A group of students decided to investigate which colours were most attractive to honey bees.

They set out four trays of different colours in a meadow of wild flowers and four in a garden.

Each tray was lined with a harmless sticky glue to catch any bees which landed on the trays.

They left all the trays for 12 hours (7am to 7pm) and then recorded the number of bees found in each tray.

The bees were then released at the end of the investigation.
Their results are shown in the table below.

<table>
<thead>
<tr>
<th>colour</th>
<th>number of honey bees</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>meadow</td>
<td>garden</td>
</tr>
<tr>
<td>blue</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>yellow</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>red</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>white</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

(c) Suggest why you think these four colours were chosen.

.............................................................................................................................................. (1)

(d) Describe the students’ results for the number of honey bees found in the different trays in both areas.

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..............................................................................................................................................
.............................................................................................................................................. (3)

(e) Using the results of the investigation, or otherwise, suggest ways in which the population of honey bees could be increased.

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..............................................................................................................................................
..............................................................................................................................................
..............................................................................................................................................
..............................................................................................................................................
.............................................................................................................................................. (2)

(Total marks: 60)