SAMPLE SCHOLARSHIP EXAMINATION PAPER

For pupils currently in Year 8

SCIENCE
(BIOLOGY, CHEMISTRY, PHYSICS)

Time: 1 hour 15 minutes

You should spend no more than 25 minutes on each section.

Calculators can be used.

Answer all questions in the spaces provided.
Candidates may be required to plot graphs and measure lengths and angles, so should bring a pen, pencil, ruler, rubber and protractor to the exam. The examination will mainly cover the topics taught in U3 (Year 7) and L4 (Year 8) at Freemen’s. The topics are reproduced below.

**Biology**
Questions will be more skills than content-based and may involve questions such as drawing a graph, analysing data and evaluating experimental methods. Candidates might also be given some unfamiliar biological information and asked questions about it. The topics covered where factual recall is required could include the following, which are studied in Years 7 and 8 at Freemen’s.

- Animal behaviour
- Cells and microscopes
- Classification
- Health and disease (microorganisms)
- Plant and Animal Reproduction
- Scientific design and interpretation
- Senses

**Chemistry**
- Acids and Alkalis: acids and alkalis, indicators, pH, everyday applications and environmental problems
- Physical Separations and Changes: filtering, evaporation, distillation, fractional distillation, chromatography, states of matter, changes of state, effect of impurities, diffusion
- Chemical changes and corrosion: thermal decomposition, burning and oxidation, rusting, precipitates and effervescence
- Elements, Compounds and Mixtures: atoms and symbols for elements, compounds/mixtures, interpretation of formulae and particle diagrams

**Physics**
- Forces: their effects, electromagnets, Hooke’s Law, pressure and moments
- Density
- Energy changes and efficiency
- Electrical circuits
- Reflection and refraction of light
- General knowledge of satellites and the Solar System

Pupils wishing to attempt question practice should purchase any book of Key Stage 3 examination-style questions.
BIOLOGY

B1. The masses of a brother and sister were recorded during the years of their growth as follows.

<table>
<thead>
<tr>
<th>age in years</th>
<th>boy</th>
<th>girl</th>
</tr>
</thead>
<tbody>
<tr>
<td>birth</td>
<td>4.5</td>
<td>3.5</td>
</tr>
<tr>
<td>2.5</td>
<td>15.5</td>
<td>13.6</td>
</tr>
<tr>
<td>5</td>
<td>20.0</td>
<td>15.5</td>
</tr>
<tr>
<td>7.5</td>
<td>24.1</td>
<td>22.5</td>
</tr>
<tr>
<td>10</td>
<td>32.7</td>
<td>27.7</td>
</tr>
<tr>
<td>12.5</td>
<td>38.6</td>
<td>40.9</td>
</tr>
<tr>
<td>15</td>
<td>59.1</td>
<td>50.5</td>
</tr>
<tr>
<td>17.5</td>
<td>64.5</td>
<td>54.1</td>
</tr>
<tr>
<td>20</td>
<td>65.9</td>
<td>54.9</td>
</tr>
</tbody>
</table>

a) Plot these figures on graph paper using one pair of axes. From the graph, answer the following questions. [6]

b) At what age was the girl heavier than her brother?

__________________________________________________________ [1]

c) Which child showed the greatest annual increase in mass?

__________________________________________________________ [1]

d) Between what ages did this greatest growth rate occur?

__________________________________________________________ [1]

e) What was this annual increase in mass?

__________________________________________________________ [1]

f) Give one reason for this maximum growth rate occurring in this child at this age.

__________________________________________________________ [2]

g) What was the increase in mass per year at the time of the slowest growth rate in either child before the age of 13?

__________________________________________________________ [1]
Sourdough bread is light in texture and tastes slightly sour. It is made using two types of microorganism, a yeast and a bacterium. The bacterium can make acids such as lactic acid. This acid makes the bread taste sour.

2 (a) The diagrams above show the structures of the yeast cell and the bacterial cell.

2 (a) (i) Both the yeast cell and the bacterial cell have structures A and B. Name structures A and B.

A ..........................................................................................................................................

B ..........................................................................................................................................

(2)

2 (a) (ii) The yeast cell and the bacterial cell have different shapes. Give one other way in which the structure of the bacterial cell is different from the structure of the yeast cell.

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(1)
2 (b) The graph shows how the growth rates of the yeast and the bacteria change with temperature.

2 (b) (i) Describe 1 similarity and 1 difference between the growth rate of Bacteria and Yeast

Similarity

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Difference

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(2)

2 (b) (ii) The bread has a sourer taste if it rises at 32 °C than it does if it rises at 25 °C. Suggest why.

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(2)
In the winter wild birds cannot find food easily. A student carried out an investigation to find the best kind of food to put out for wild birds in winter.

- She nailed six black dishes to a piece of wood.
- She put 100 g of a different type of seed into each dish.
- She placed the piece of wood in her garden.
- She observed the birds that visited each of the dishes before school, after school and at weekends.
- At the end of the investigation, she weighed the amount of each type of seed remaining.
- She also calculated the percentage of each type of seed that was eaten by the birds.

(a) Name two control variables in this investigation.

1. ...............................................................................................................................  
2. ...............................................................................................................................  

(b) Table 1 below shows the number of bird visits to each dish of seeds that she recorded.

<table>
<thead>
<tr>
<th>Bird species</th>
<th>Number of visits to each dish of seeds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Corn</td>
</tr>
<tr>
<td>Morning Dove</td>
<td>12</td>
</tr>
<tr>
<td>Red-bellied Woodpecker</td>
<td>1</td>
</tr>
<tr>
<td>Dark-eyed Junco</td>
<td>3</td>
</tr>
<tr>
<td>Northern Cardinal</td>
<td>0</td>
</tr>
<tr>
<td>American Goldfinch</td>
<td>0</td>
</tr>
<tr>
<td>House Finch</td>
<td>1</td>
</tr>
<tr>
<td>House Sparrow</td>
<td>16</td>
</tr>
<tr>
<td>Total visits</td>
<td>33</td>
</tr>
</tbody>
</table>

Table 1

(b) Which type of seed had visits from the greatest number of different bird species?  
...............................................................................................................................  

(1)
(c) The table below shows:

- the percentage of each type of seed eaten
- the percentage of fat in each type of seed

<table>
<thead>
<tr>
<th>Type of seed</th>
<th>Percentage eaten</th>
<th>Percentage of fat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>68</td>
<td>2</td>
</tr>
<tr>
<td>Niger</td>
<td>77</td>
<td>40</td>
</tr>
<tr>
<td>Safflower</td>
<td>86</td>
<td>3</td>
</tr>
<tr>
<td>Sunflower</td>
<td>91</td>
<td>35</td>
</tr>
<tr>
<td>Peanut</td>
<td>4</td>
<td>48</td>
</tr>
<tr>
<td>Millet</td>
<td>99</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 2

(c) (i) The girl concluded that the most popular seeds for the birds were the seeds with the highest percentage of fat.

Was her conclusion justified by the data in Table 2?

Draw a ring round your answer. Yes / No

Give a reason for your answer.
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........................................................................................................................................................................
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(1)

(c) (ii) Most winter bird food for sale in shops contains niger and sunflower seeds.

Use the information in Table 1 and Table 2 to suggest a reason why.
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........................................................................................................................................................................
........................................................................................................................................................................
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(1)
C1. You are given a mixture of powdered limestone which is insoluble in water, and salt, which is soluble in water. Describe and explain what you would do in order to obtain separate samples of salt and limestone from the mixture.

_______________________________________________________
_______________________________________________________
_______________________________________________________
_______________________________________________________
_______________________________________________________
_______________________________________________________
_______________________________________________________
_______________________________________________________

C2. The diagrams labelled A and C represent particles in two states of matter.

![Diagram]

a] Complete the diagram labelled B to show the arrangement of particles in this state.
C2. b] The particles in C are in the liquid state. In what state are the particles in A?

__________________________________________________

c] How does the movement of particles in state C differ from state A?

__________________________________________________

d] How could state C be converted to state A?

__________________________________________________

e] Name the process when state A is converted to state B.

__________________________________________________ 

(5)

C3. a] Sometimes the lettering on gravestones becomes blurred. What process has occurred?

__________________________________________________

b] Name 2 factors that could cause the process to take place.

1. ________________________________________________

2. ________________________________________________ (3)
C4. An acid solution and alkaline solution were mixed in the volumes given in the table and the resulting solutions were tested with universal indicator.

One mixture was neutral (pH 7), one had a pH value of 13 and the third had a pH value of 1.

a] Complete the following table

<table>
<thead>
<tr>
<th>Volume of acid (cm$^3$)</th>
<th>Volume of alkali (cm$^3$)</th>
<th>pH value</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>17</td>
<td></td>
</tr>
</tbody>
</table>

(3)

b] Was the original acid or the original alkali more concentrated?

__________________________________________________________ (1)

c] State the colour that Universal indicator would go in

acidic solution  __________________________
neutral solution __________________________
alkaline solution __________________________ (2)

d] Give an example of a neutralisation reaction that takes place outside the laboratory. Explain what is used, and why.

__________________________________________________________
__________________________________________________________
__________________________________________________________
__________________________________________________________

(3)
A neutralisation reaction resulted in the formation of a compound with the formula Ca(NO₃)₂.

i) What is the chemical name of Ca(NO₃)₂?

ii) How many elements are there combined in the formula?

Ben put a beaker weighing 50 g on a balance. He added 50 g of dilute hydrochloric acid and 2.5 g of calcium carbonate to the beaker. The total mass of the beaker and its contents was 102.5 g.

The Hydrochloric acid reacted with the calcium carbonate. How could Ben tell that a chemical reaction was taking place in the beaker?
b) The word equation for the reaction which took place is:

\[ \text{hydrochloric acid} + \text{calcium carbonate} \rightarrow \text{calcium chloride} + \text{carbon dioxide} + \text{water} \]

When the reaction stopped, the total mass had decreased from 102.5 g to 101.4 g.
Some water had evaporated from the beaker.
What else caused the drop in mass?
Use the word equation to help you answer the question.

\[ \ ]^{(1)} \]

When the reaction stopped, Ben tested the contents of the beaker with universal indicator paper. The calcium carbonate had neutralised the acid.

What is the colour of universal indicator paper in a neutral solution?

\[ \ ]^{(1)} \]

d) Which two materials in the list below are mainly calcium carbonate?

Tick the correct boxes.

 coal □

glass □

limestone □

marble □

sandstone □
C6.  a] When alcohol burns heat energy is released.

What word describes a reaction when heat is given out?

__________________________________________________ (1)

b] When the alcohol burns carbon dioxide and water form.
What does this tell you about the elements in alcohol?

__________________________________________________

__________________________________________________

__________________________________________________ (1)

c] What chemical would you use to show water was formed?

__________________________________________________ (1)

d] When coal is burnt several products are formed.
One or more of these can be considered to be a pollutant of the air.

[i] Name one pollutant.

__________________________________________________

[ii] State why it is harmful to the environment.

__________________________________________________

__________________________________________________

__________________________________________________ (2)
Richard wants to use the scissors shown to cut some thick card.

(a) Is it best for him to grip the handles near the places marked P or near those marked Q? Explain your answer.

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

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

(b) Is it better for the edge of the card to be positioned at the places on the blades marked R or at those marked S?

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

(c) The scissors are more likely to cut the card if the blades are sharp than if they are blunt. Explain why.

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

Total marks: 6
P2. Holly does an experiment to investigate the stretching of a spring. She measures the length of the spring as she gradually increases the stretching force. Her results are shown in the table.

<table>
<thead>
<tr>
<th>force in N</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>length in cm</td>
<td>7.0</td>
<td>9.3</td>
<td>11.6</td>
<td>13.9</td>
<td>16.2</td>
<td>18.8</td>
<td>22.0</td>
</tr>
</tbody>
</table>

(a) Name the instrument which Holly could use to measure the stretching force which she was using.

(1)

(b) Plot the data on the graph grid below and draw a suitable graph line.

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Turn-over

S0115 ✓ 13+SCI
(c) What is the original length of the spring?

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

(d) When the stretching force is about 5.5 N, the spring reaches its limit of proportionality.

Explain what this statement means.

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

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

(e) What should Holly do to see whether her spring has gone past its elastic limit when the stretching force is 6 N?

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

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

Total marks: 10
A student investigates the density of a liquid.

The student uses scales that show mass to the nearest gram.

The student uses a measuring cylinder that is marked with volume in cm³.

First the student puts an empty measuring cylinder on the scales.

Then the student puts some liquid into the measuring cylinder.

Then the student looks at the level of liquid in the measuring cylinder.

Turn-over
(a) Complete the results table for this investigation.

<table>
<thead>
<tr>
<th>mass of measuring cylinder and liquid</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>mass of empty measuring cylinder</td>
<td></td>
</tr>
<tr>
<td>.: mass of liquid in cylinder</td>
<td></td>
</tr>
<tr>
<td>volume of liquid</td>
<td></td>
</tr>
</tbody>
</table>

(4)

(b) Calculate the density of the liquid. Give your answer with the correct unit.

Density = ……………………

(3)

(c) Suggest two ways in which the student could improve the investigation to give a more accurate value for the density.

1. ……………………………………………………………………………………
   ……………………………………………………………………………………
   ……………………………………………………………………………………

2. ……………………………………………………………………………………
   ……………………………………………………………………………………
   ……………………………………………………………………………………

(2)

Total marks: 9

END OF EXAM