Grade 7 Natural Science Worksheet

Assessment Task: Physical Sciences: measurement, graphs

Measurement of mass

Part One: Measuring Baby Bongi

Mrs Skosana visited the clinic every month to find out how her baby, Bongi, was growing. Each month, the clinic sister wrote down Bongi's mass on a strip of card stapled to Bongi's clinic progress card. Although Mrs Skosana was happy to see Bongi's mass increase steadily, she wanted to get a better picture of Bongi's growth. Mrs Skosana asks you for some help.

1. Draw a graph of Baby Bongi's growth.

Bongi's mass at:

Birth	– 3.4 kg
1 month	– 4 kg
2 months	– 5 kg
3 months	– 6.3 kg
4 months	– 7 kg
5 months	– 7.4 kg
6 months	– 8.1 kg
7 months	– 7.9 kg
8 months	– 8.2 kg
9 months	– 8.6 kg
10 months	– 9.3 kg

[10 marks]

2. What was Bongi's mass when she was 6 weeks old?
3. At what age did she have a mass of 5.5 kg?
4. Bongi's mass dipped around 7 months. Can you give a possible explanation for this?
5. Do you think the loss in mass is anything for Mrs Skosana to be worried about?
6. Predict Bongi's mass at 11 months.

[14 marks]

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Part Two:

The table below shows the body mass of four different mammals. It also shows how much lung surface area they have for every gram of their body mass, and how rapidly they use up oxygen at rest.

Mammal	**Body mass (g)**	**Surface area of lungs per g of body mass (cm^2)**	**Volume O_2 used per minute (cm^3 per g of body mass)**
Bat	10	100	1 500
Mouse	20	54	3 600
Rat	300	33	770
Man	70 000	11	200

1. Describe the relationship between body mass and surface area of lungs per gram of body mass.
2. Suggest an explanation for this relationship, in terms of oxygen consumption.
3. Explain why a large mammal like man uses much less oxygen per minute per gram of body mass than a small mammal like a mouse.
4. a) From the data in the table, work out the total surface area of the lungs of a bat.
   b) Explain how this large surface area is achieved (the lungs are similar in structure to those of other mammals).
5. Suggest why the bat has a larger lung surface area for its size than a mouse, even though its oxygen consumption at rest is less than that of a mouse.

[16 marks]

[Total: 40 marks]

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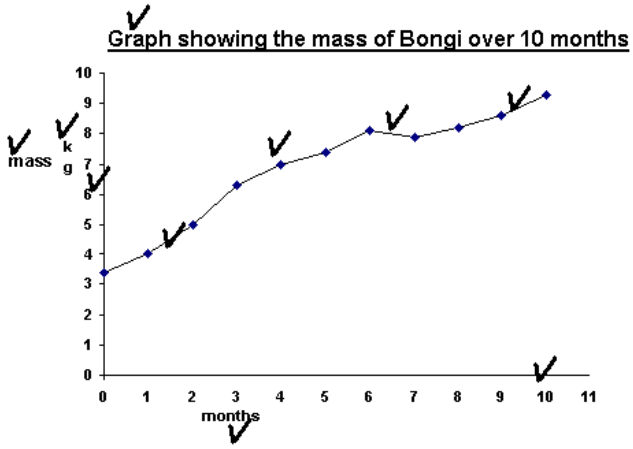
Suggested Solutions

Question number	Possible marks	Solution
1.1	10	
1.2 - 6	14	2. 4.5 kg ✓✓ 3. 2.5 months ✓✓ 4. Bongi could have been ill, ✓ a cold, diarrhoea, an infection – any small illness could have caused her to become disinterested in food and lose some of her mass. ✓ She could have been teething ✓and it may have been sore for her to eat – she could have been off her food. ✓ 5. There is no real cause for alarm, as the graph shows that she has picked up her rate of growth again, ✓✓ the graph shows a healthy increment. ✓✓ 6. Between 9.8 and 10 kg ✓✓
2	16	This problem deals with the metabolic rate of certain mammals. You need to make sure that for valid comparisons to be made, data must be expressed in standard form, i.e. per gram of body mass. If this is not done, then one cannot compare animals of differing sizes. 1. The larger the mass of the mammal, the smaller the surface area of the lungs per gram of body mass. ✓✓ 2. Larger mammals in general consume less oxygen per gram of body mass than smaller ones. ✓✓ 3. A small mammal has a large surface area in relation to its volume and mass. Its rate of heat loss is thus relatively larger. Therefore, its metabolic rate is higher in order to maintain body temperature, and so its oxygen requirements are greater. Hence it needs a larger lung surface area in proportion to its size in order to absorb enough oxygen. ✓✓✓✓ 4. a) 100 x 10 ✓= 1 000 cm^3 ✓✓ b) Large surface area of the lungs results from the large number of

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		branches of the tubes in the lungs (bronchioles) and the expansion of the ends of these to form vast numbers of air sacs (alveoli) where gas exchange takes place. ✓✓✓ 5. The most obvious suggestion is that its oxygen requirements for rapid flight are greater than those of a mouse at its most active. ✓✓