ST PAUL'S SCHOOL
JUNIOR SCHOLARSHIP EXAMINATION

BIOLOGY

NAME _____

MAY 2014

SECTION B – BIOLOGY

There are roughly 6000 different species of mammal. This diverse order of vertebrates has colonised every land continent, as well as evolving ways to conquer water and air.

Almost a fifth of all mammal species are bats. Many bats in the tropics have a diet of fruit and pollen.

1. Suggest what essential nutrients the fruit and pollen might provide.

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…… [2]

Almost all bat species in temperate zones are insectivores, such as the pipistrelle (Fig. 1), which is Britain's most common bat. They use echolocation to catch insects in flight, homing in on their insect prey in total darkness.

Figure 1. A pipistrelle bat.

2. Looking at the pipistrelle in flight, which parts of the bat's body do you think could be used to catch prey?

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In temperate zones bats hibernate through the winter months, typically moving from their feeding grounds to a damp cave, which is a few degrees warmer than outside. They enter a state of deep torpor, letting their body temperature drop several degrees, hanging motionless upside down, and not feeding or drinking. They survive off their stored body fat.

3. Why do you think bats in temperate zones have evolved to hibernate?

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…… [3]

Bats choose damp locations for hibernation, in order to reduce water loss from breathing.

4. How might they generate water during their torpor, without actually drinking or eating?

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…… [1]

Bats feed intensely in the weeks leading up to hibernation, increasing their body mass by laying down fat reserves. As they hibernate, their body mass decreases. In a study investigating the change in body mass of hibernating pipistrelles, the mass of a population of bats was measured for 18 weeks during their hibernation period.

The mean mass of bats over the time period is shown in the table below.

Week number	**Mean mass (g)**
0	8.1
2	8.0
4	7.8
6	7.5
10	7.0
12	6.6
14	6.3
16	5.9
18	5.7

5. Plot the data in the table above on the graph paper supplied. Join the points using straight lines. [3]

6. Use the graph to estimate the average mass of bats in week 9.

…… [1]

TURN OVER

7. If it is permanently dark inside the cave, what might be the trigger that wakes the bats from their hibernation?

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…… [1]

Female bats almost never give birth to more than one offspring in each litter.

8. Suggest two reasons why bat twins might be so rare.

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The largest land animals are mammals – the heaviest is the African elephant, and the tallest is the giraffe. They are both herbivores, but like all mammals they lack the enzyme required to break down the tough plant cell walls that make up the bulk of their food.

Elephants rely on bacteria in the last section of their digestive tract to break down the cellulose, but more than 75% of the plant matter they eat is undigested.

Giraffes are ruminants. Like cows, they have a complex multi-chambered stomach (Fig. 2).

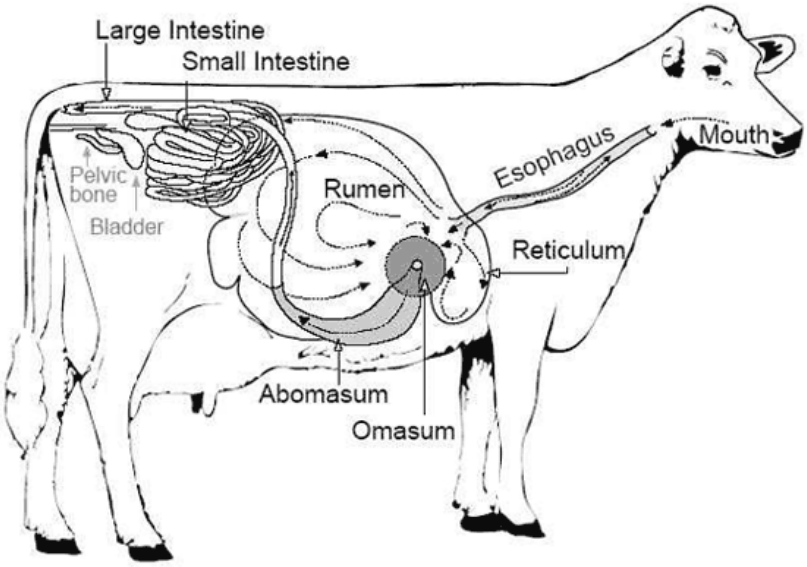

Fig. 2. The digestive system of a cow.

In the rumen, they maintain colonies of many different bacteria and other microorganisms which are highly effective at digesting plants. The microorganisms multiply and are then digested themselves by the giraffe. Ruminants periodically regurgitate their food back up to the mouth from the rumen, for further chewing.

Overall, about 50% of the plant matter ruminants eat is undigested.

9. Would you expect elephants or giraffes to eat more food per kilogram of body mass? Give a reason for your answer.

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…… [2]

10. Draw two food chains showing the different ways elephants and giraffes get their nutrients.

[2]

TURN OVER

Fig. 3. A mother and young giraffe.

New born giraffes have no microorganisms in their rumens.

11. Suggest how they obtain the microorganisms from their mothers.

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12. How would you expect conditions in the rumen to differ from those in your own stomach, and why?

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…… [2]

The largest animal ever to have lived is also a mammal – the Blue whale (Fig. 4)

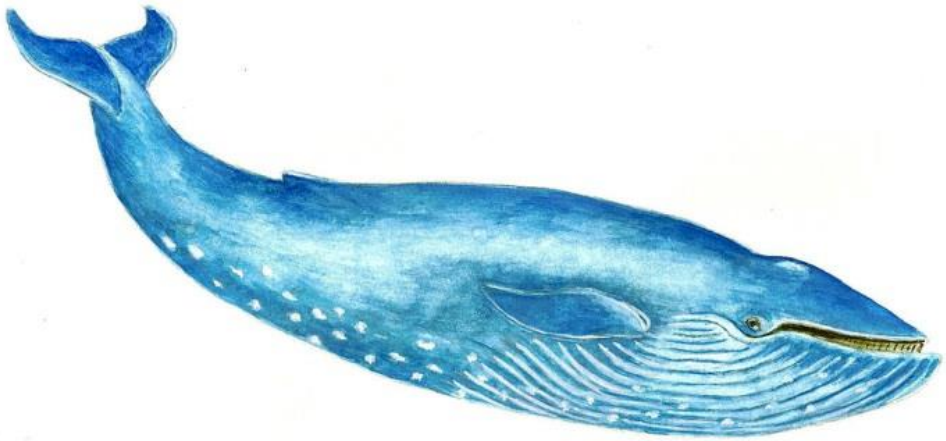

Fig. 4. The Blue whale.

Blue whales typically migrate thousands of miles each year from cooler feeding waters near the Poles to breeding sites nearer the equator.

Little is known about them, since they are rare and spend so much of their time feeding underwater, submerging for half an hour at a time.

13. Suggest two fundamental questions scientists might investigate about blue whales, based on this information.

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END OF BIOLOGY

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