



ST PAUL'S SCHOOL  
Est. 1509

# **JUNIOR SCHOLARSHIP EXAMINATION**

**MAY 2018**

**BIOLOGY**

**30 minutes**

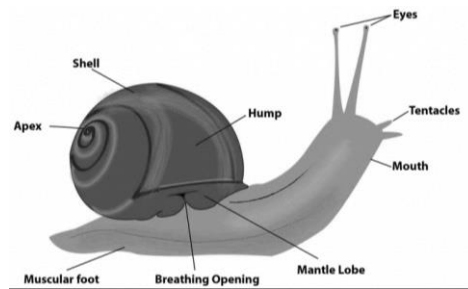
**Answer the questions in the spaces provided**

**Name:** .....

The molluscs are a phylum of invertebrate animals that contains about 100,000 different species, including snails, slugs, clams, mussels, octopuses and squid.

Over half of all the mollusc species are slugs and snails, which are the only members of the phylum that can survive on land. Slugs and snails are very similar, apart from the hard protective shell.

Slugs and snails move on land using rhythmic contractions of their muscular foot (Fig.1).



**Fig. 1.** *Anatomy of a snail.*

The sticky mucus trail they leave behind helps them move, allowing them even to climb trees, although they generally avoid sharp, rough terrain and hot, dry surfaces.

**1. Suggest two different ways in which the mucus helps them move on land.**

- (i) .....
- .....
- (ii) .....
- .....

[2]

Garden snails (*Cornu aspersum*) eat plants by scraping away thin layers of plant tissue with their rough radula (tongue-like structure), leaving a characteristic pattern of damage to leaves, as shown in Fig.2.



**Fig.2.** *Snail damage to a plant leaf*

**2. What is the trophic level of garden snails?**

..... [1]

Slugs and snails can cause considerable damage to plants, and may significantly reduce crop yields for farmers.

**3. Apart from removing the surface layers of plant tissue, how else might grazing by slugs and snails damage plants?**

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 .....

[1]

Despite the damage they do to garden plants, snails are an important part of the diet of many garden birds, which struggle to reproduce when snails are scarce even if there are plenty of slugs.



*Fig.3. Thrush eating a garden snail*

**4. Suggest why snails are so important to the diet of garden birds.**

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 .....

[1]

Garden snails are generally most active at night, travelling up to 40 metres in a few hours, often spending the day motionless in a particular dark crevice that they return to time after time.

**5. Suggest two reasons why the snails are more active at night.**

- (i) .....
- .....
- (ii) .....
- .....

[2]

Experiments have shown that some garden snails, despite having very poor eyesight, have a remarkable ability to find their way back to their daytime location, even after being thrown over the fence into a neighbour's garden.

**6. Suggest how a snail which has been thrown into a neighbour's garden might find its way back to its starting point in its own garden.**

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[2]

Garden snails are hermaphrodites, having both male and female sex organs, and can self-fertilise their own eggs.

**7. Suggest an advantage to the snail of being able to fertilise its own eggs.**

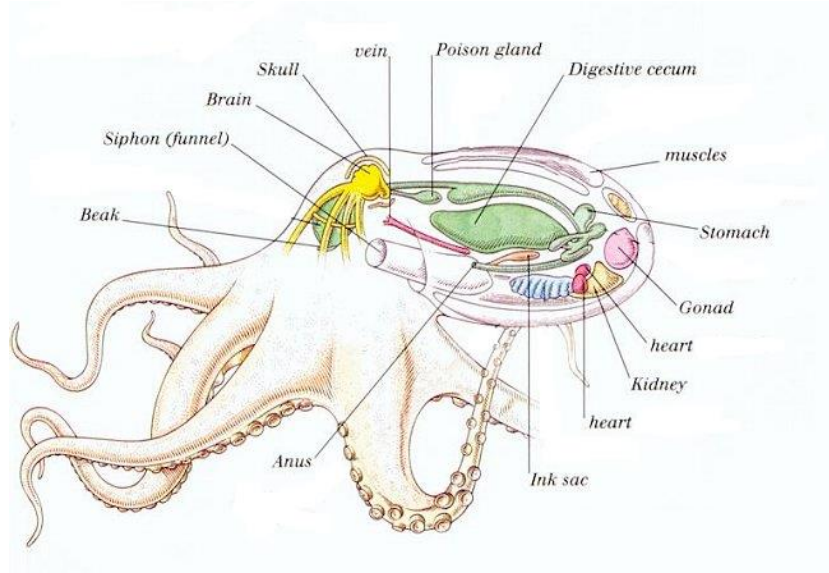
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[1]

The cephalopods (squid, octopus, cuttlefish and nautilus) are also molluscs.

Octopuses possess a complex nervous system that is very different from ours. They have a central doughnut shaped brain linked to their eyes, but two thirds of their nerve cells are in eight separate mini-brains, one to control the movement of each of their eight arms.



*Fig.4. The anatomy of an octopus.*

**8. Suggest why controlling an octopus arm is far more complex than controlling a human arm.**

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[2]

Some species of octopus are highly intelligent – in captivity they are able to manipulate tools, recognise specific human researchers and indulge in what appears to be playful behaviour.

An experiment was recently conducted to see which toys a captive giant pacific octopus (*Enteroctopus dofleini*) most enjoyed. Three simple plastic toys – a ball, a cow shape with three rings, and a pair of opening pliers - were repeatedly placed in the tank with the octopus, one at a time: ball, then cow, then pliers.



**Fig.5.** The three toys presented to the octopus

The time the octopus spent handling each toy before letting it go was recorded:

Trial	Time spent handling cow (s)	Time spent handling ball (s)	Time spent handling pliers (s)
1	68	22	37
2	46	10	23
3	24	11	16
4	22	9	14
Average			

**10. Calculate the average time for each toy and write the answer in the table of results above. Give your answers to 1 decimal place.**

[3]

**11. Looking at the results, explain which toy the experiment suggests the octopus most enjoys.**

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[2]

**12. Suggest what features of a toy might lead the octopus to spend longer handling it.  
(All the toys were silent and had no smell).**

.....  
 .....[1]

The giant squid (*Architeuthis duxi*), also a member of the cephalopod mollusc family, is by far the largest invertebrate. Very little is known about giant squid, which live in the deep ocean, more than 300 metres below the surface, in near total darkness. Most of what we know comes from studying dead specimens caught in fishing nets, or washed up on shore.



**Fig.6.** *A Giant squid washed up on a beach in Australia*

Giant squid are carnivores, mainly eating other squid species, many of which are bioluminescent – generating a faint glow over their bodies.

**13. Suggest why an animal might have evolved to glow in the dark, even though it makes it easier for predators to find it.**

.....  
 .....  
 .....  
 .....[2]

The main predator of giant squid are thought to be sperm whales, which we know can dive to 1000 metres deep and often have marks on their skin left by the rasping suckers on giant squid tentacles.

**14. A single sperm whale may eat as many as 10 adult giant squid each day. If this is the case, and there are 350,000 sperm whales in the world's oceans, calculate the total number of squid that this many sperm whales would eat each year.**

.....

.....

[1]

**15. If this many are being eaten each year, explain why the total number of giant squid would have to be even higher than this number.**

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[1]

Some scientists believe that there may actually be several billion giant squid – as many as there are human beings.

**16. Why would it be surprising if so many big carnivores are living so deep in the ocean?**

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[3]

[Total for paper: 25 marks]

**END OF PAPER**