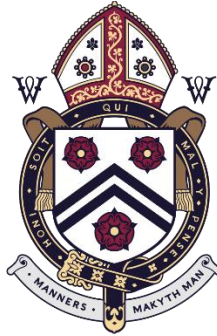


<i>School</i>	<i>Candidate's Name (PLEASE PRINT)</i>
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WINCHESTER
COLLEGE

Election

2021

Science

BIOLOGY

THEORY SECTION

Time allowed: 25 minutes

Write all your answers in the spaces on this question paper

1 Fig. 1 shows a fossil of a dragonfly. The fossil species lived in the Carboniferous period but went extinct 360 million years ago. Also shown is a silhouette of the largest dragonfly alive today. The two are to scale. On the image is a red line that represents 1 metre in real life.

(a) If the length of the red line on the image when measured with a ruler is 45 mm what percentage of the real size is the image?

.....%

[2]

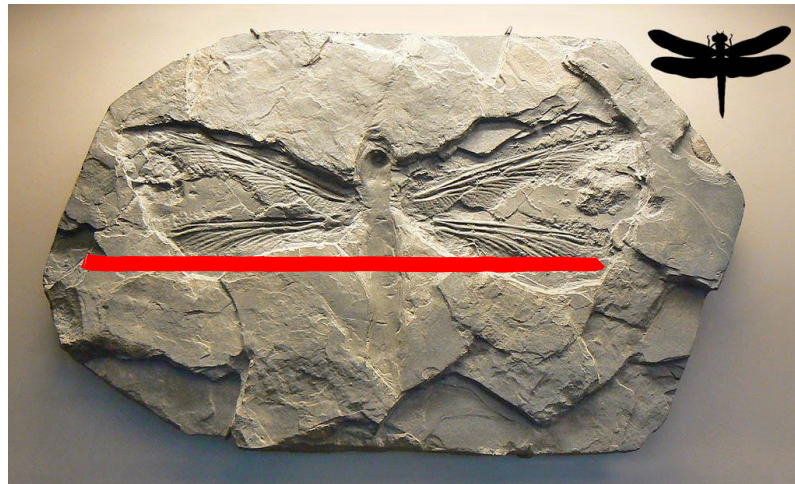


Fig. 1

During the Carboniferous the dragonflies were the first and only flying animals on Earth. The land was 80% covered in tropical tree ferns creating a huge rain forest. Today the forest cover is around 15%.

The oxygen in the air in the Carboniferous made up 35% of the volume whereas today oxygen makes up 21% of the volume of air.

All insects have a primitive respiratory system which is a system of air sacs and tubes called *trachea* which enter the body along the sides through small pores called *spiracles*. This system is not very efficient.

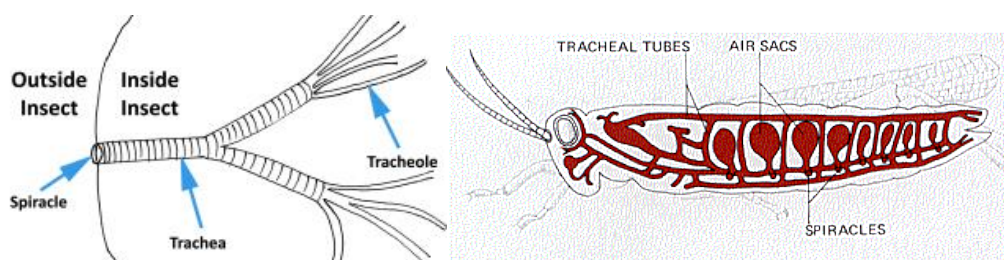


Fig. 2



Fig. 3 – an artist's impression of the Carboniferous

- (b) Explain in as much detail as you can why the oxygen percentage was so much higher in the Carboniferous than today.

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[4]

- (c) Using the information above give two reasons why the largest dragonfly in the Carboniferous is so much larger than the largest species today.

Reason 1.....

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[2]

Reason 2.....

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[2]

Dragonflies belong to a group of insects called *exopterygota* which includes locusts, cockroaches and stick insects. This group has 130,000 species worldwide. These insects have a lifecycle in which a nymph (a small version of the adult) hatches from the egg. The nymph gets steadily bigger until it becomes an adult. The nymph eats the same food as the adult. The adult often lives for several years.

Another group of insects are called the *endopterygota* which includes flies, beetles, butterflies and moths, and ants, wasps and bees. This group has over 1,000,000 species and the beetles alone have 400,000 species. The key feature of their lifecycle is a complete metamorphosis where a larva (grub or caterpillar) hatches from the egg and eats an entirely different food from the adult. The larva grows rapidly then builds a pupa (cocoon) where it radically restructures its body and emerges as an adult, breeds and then dies very soon after breeding.

For example, the larva of the blowfly eats dead flesh but the adult fly eats dung and rotten fruit. Similarly, the grub of the stag beetle eats rotten wood and the adult eats plant sap.

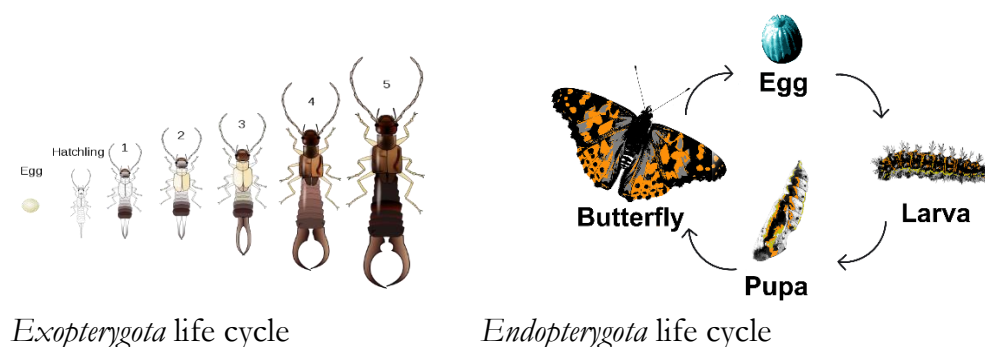


Fig. 4

- (d) Use this information to suggest why there are so many more species of *endopterygota* than *exopterygota*.

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- (e) If there are a total of 1,130,000 species of insect what percentage are *endopterygota* and *exopterygota*?

endopterygota%

exopterygota.....%

[2]

2 Breathing

Figs 5.1 – 5.3 show some images of a machine called an iron lung. It was used up until the 1960s for patients suffering from severe effects of the viral disease *Polio*. This virus can cause muscle paralysis in the breathing (intercostal) muscles of the ribcage.

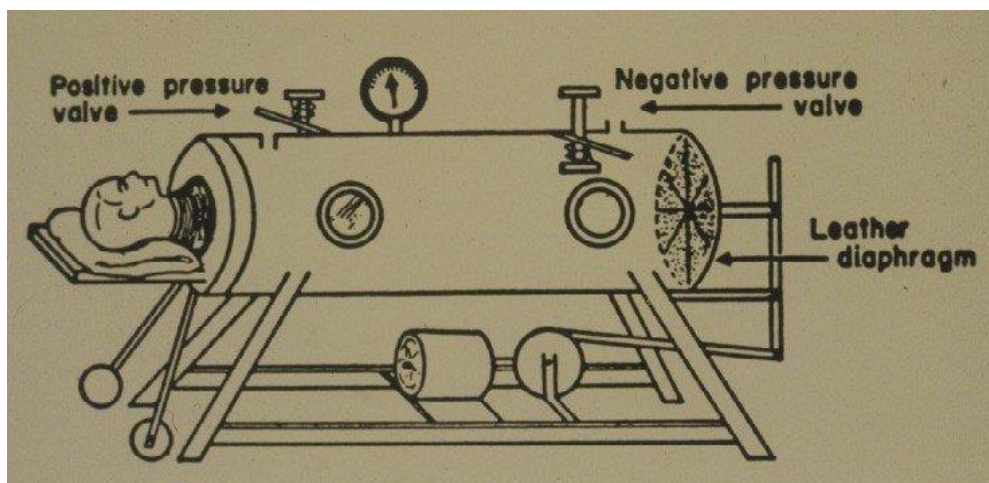


Fig. 5.1



Fig. 5.2

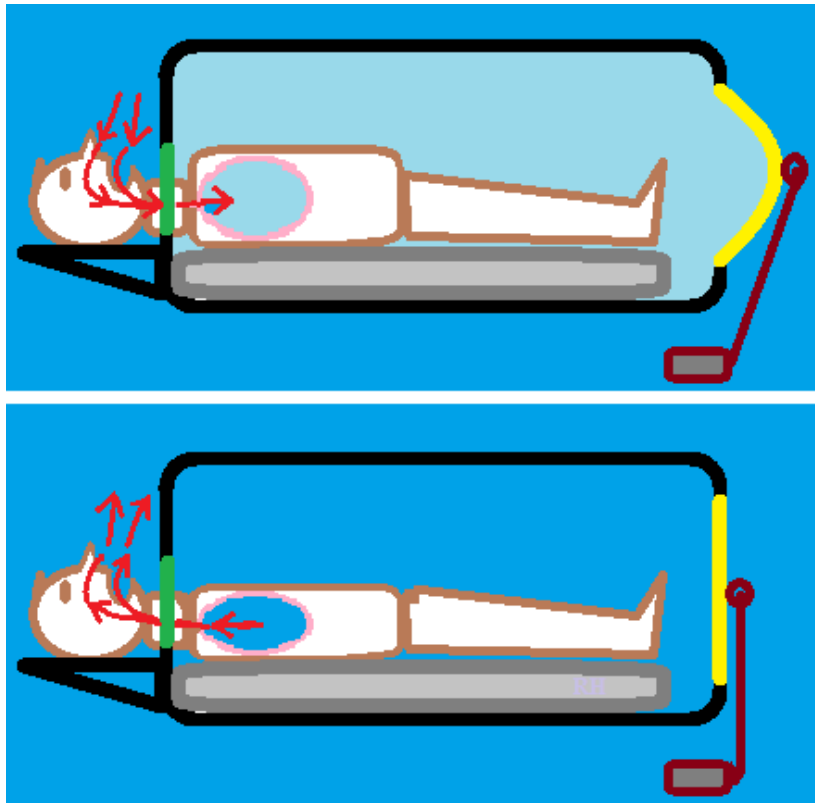


Fig. 5.3

- (a) The machine works by enclosing the patient's body in an airtight metal box with just the head poking out. Bellows attached to the end of the box raise and lower the volume of the box. Suggest how this will help the patient to breathe.

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[4]

- (b) Iron lungs are no longer used in hospitals. Suggest three reasons why.

(i)

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[2]

(ii)
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..... [2]

(iii)
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..... [2]

End of this paper

References

- Fig 1 - [GeoPicture of the week: Giant Dragonfly fossil \(zmescience.com\)](http://zmescience.com)
Fig 2 - [RESPIRATORY SYSTEM OF PERIPLANETA AMERICANA | learn zoology \(wordpress.com\)](http://learnzoology.wordpress.com)
[Tracheal Breathing \(biology-pages.info\)](http://biology-pages.info)
Fig 3 - <http://www.funkidslive.com/learn/geology-rocks/geology-rocks-carboniferous-period/>
Fig 4 - <https://biology.stackexchange.com/questions/2701/why-does-the-butterfly-have-a-cocoon-stage-in-its-life-cycle>
Fig 5.1 - <http://realmirrorofnature.blogspot.com/>
Fig 5.2 - [iron lung - Bing images](#)
Fig 5.3 - [IronLung1.jpg \(432×287\) \(ssvmmh.org\)](#)