



22146011

**BIOLOGY**  
**STANDARD LEVEL**  
**PAPER 2**

Candidate session number

--	--	--	--	--	--	--	--	--	--

Friday 9 May 2014 (afternoon)

Examination code

1 hour 15 minutes

2	2	1	4	-	6	0	1	1
---	---	---	---	---	---	---	---	---

**INSTRUCTIONS TO CANDIDATES**

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer one question.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is *[50 marks]*.

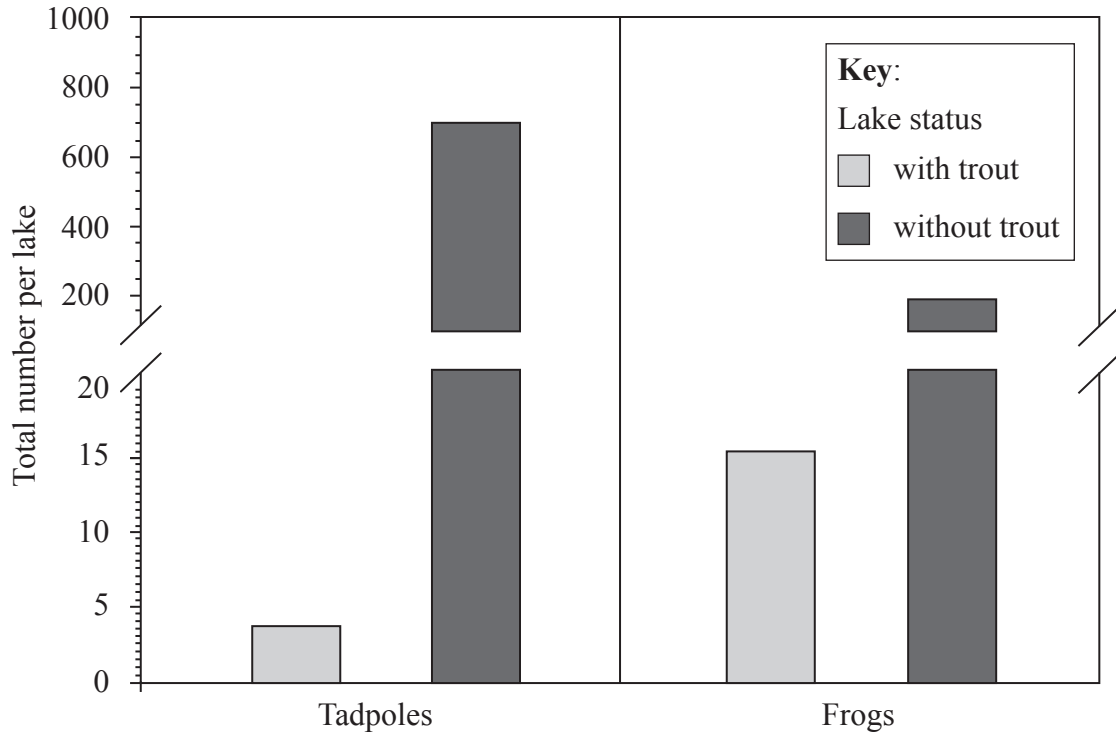


16EP01

SECTION A

Answer **all** questions. Write your answers in the boxes provided.

- 1. The mountain yellow-legged frog (*Rana muscosa*) was once a common inhabitant of the Sierra Nevada (California, USA). It has declined during the past century due in part to the introduction of non-native fish, such as trout, into naturally fish-free habitats. The bar chart shows the average number per lake of tadpoles (aquatic larval stage) and frogs in lakes with and without trout in 1996.



[Source: V. Vredenburg (2004) 'Reversing introduced species effects: Experimental removal of introduced fish leads to rapid recovery of a declining frog'. *PNAS*, 101 (20), pp. 7646–7650. Figure 2. Copyright 2004 National Academy of Sciences, USA.]

- (a) State the number of tadpoles per lake with and without trout. [1]

With trout: .....

Without trout: .....

(This question continues on the following page)



*(Question 1 continued)*

(b) Compare results for lakes with and without trout.

[2]

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

(c) The trout might affect the number of frogs or tadpoles by competing for resources. Suggest **one** other way in which trout might affect the number of tadpoles or frogs in lakes.

[1]

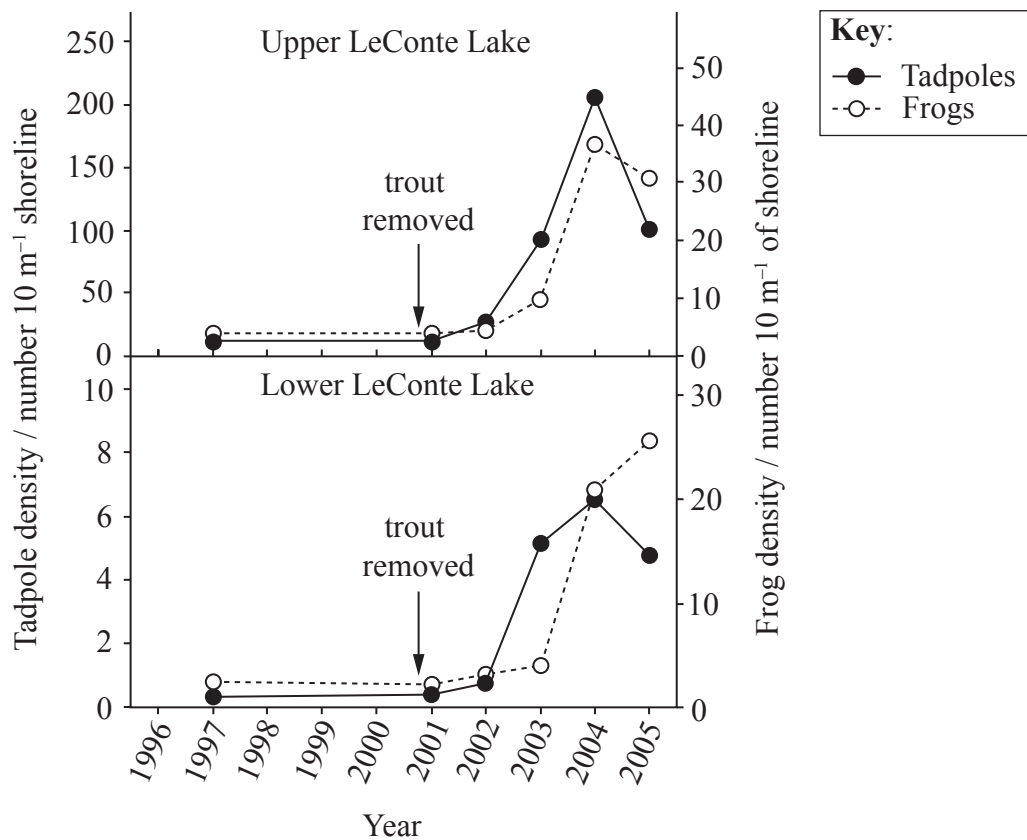
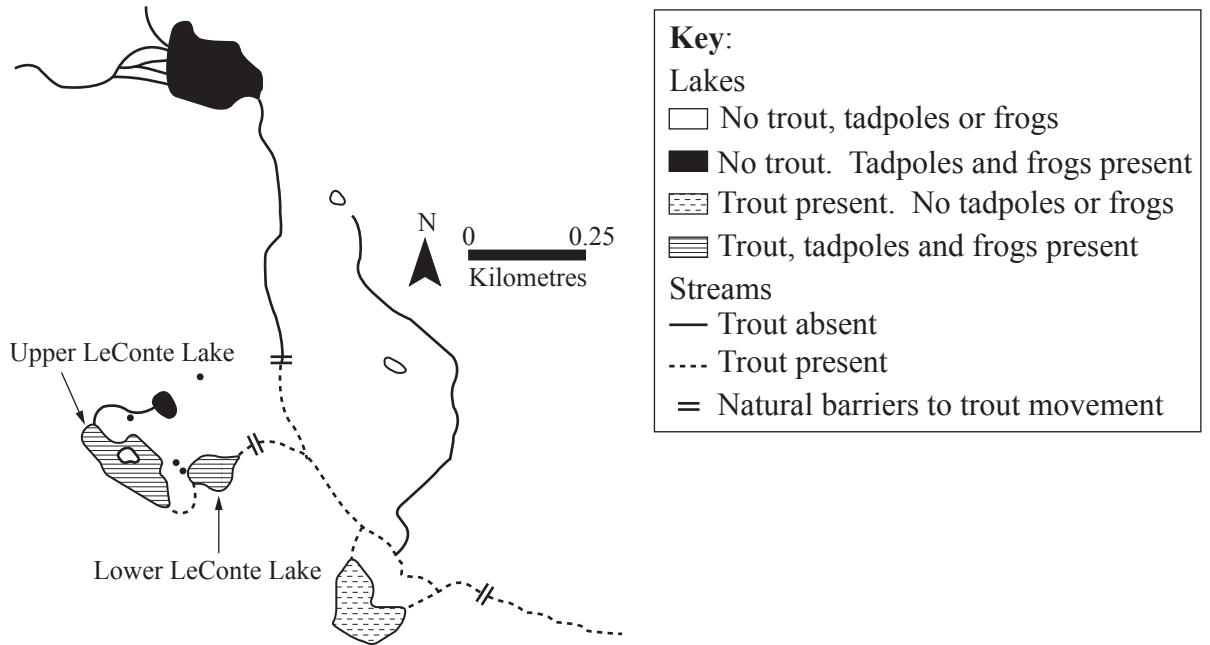
.....  
.....

*(This question continues on the following page)*



(Question 1 continued)

In order to restore the frog population, introduced trout were removed from the lakes. The map of the LeConte Basin study area shows the distribution of mountain yellow-legged frogs and trout populations just prior to the removal of the trout in 2001. The graphs show the population of tadpoles and frogs in the lakes before, during, and after the removal of the trout.



[Source: Reprinted from Knapp et al. (2007) 'Removal of nonnative fish results in population expansion of a declining amphibian (mountain yellow-legged frog, *Rana muscosa*)', *Biological Conservation*, 135 (1), pp. 11–20, with permission from Elsevier.]

(This question continues on the following page)



(Question 1 continued)

- (d) State the tadpole density in each lake in 2004. [1]

Upper LeConte Lake: ..... tadpoles 10m<sup>-1</sup> shoreline.

Lower LeConte Lake: ..... tadpoles 10m<sup>-1</sup> shoreline.

- (e) Suggest **one** possible reason for the difference in tadpole density between Upper and Lower LeConte lakes. [1]

.....

.....

- (f) Describe the effect of removing trout on frog density in Upper and Lower LeConte Lakes. [3]

.....

.....

.....

.....

.....

.....

- (g) Using the map and graph, predict whether the removal of the trout from Upper and Lower LeConte Lakes will lead to a permanent recovery in the number of frogs and tadpoles. [2]

.....

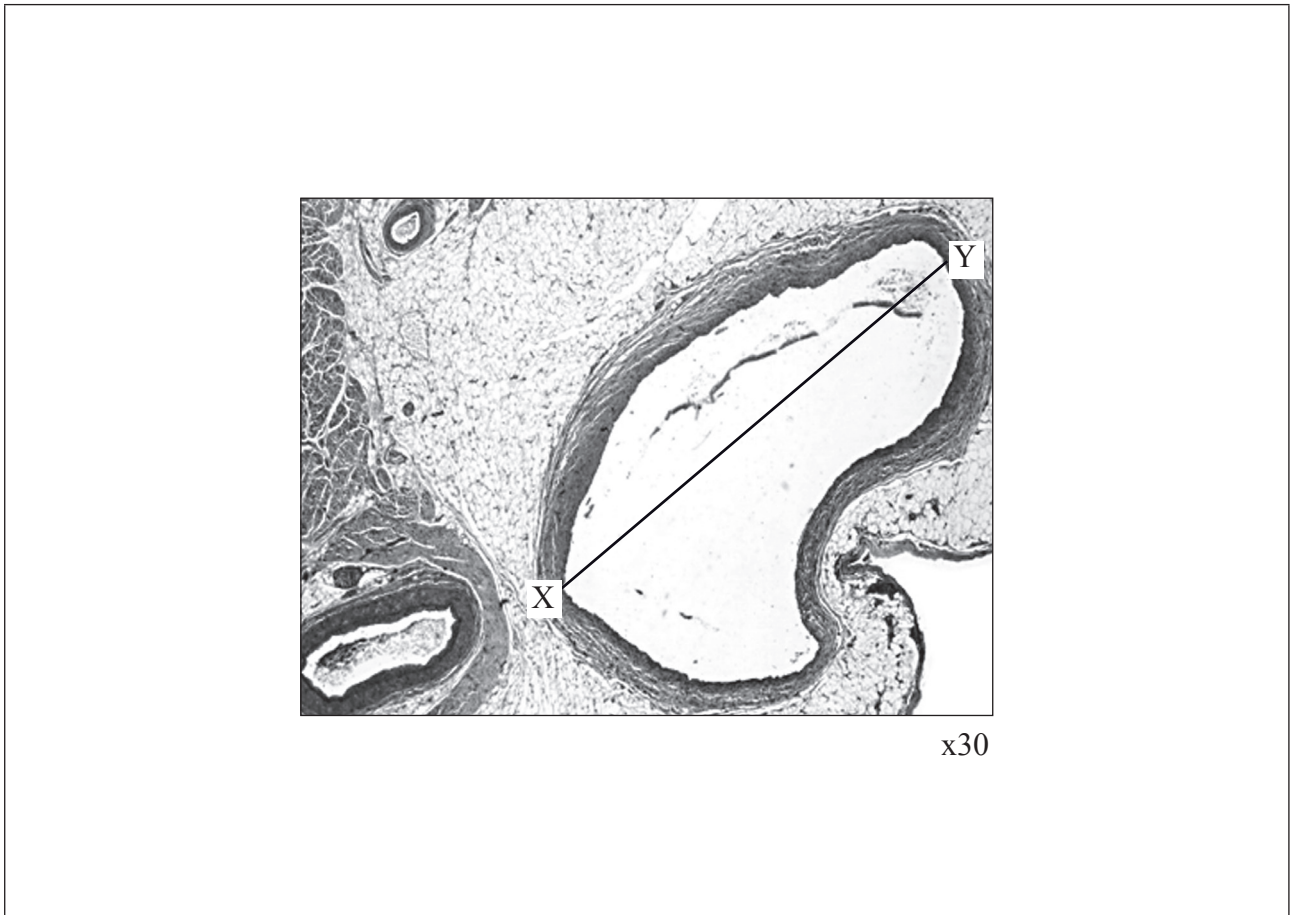
.....

.....

.....



2. The photomicrograph shows a coronary artery and a cardiac vein.



[Source: M. Ross and W. Pawlina (2007) *Histology: A Text and Atlas*, Lippincott Williams & Wilkins, Fifth edition. © Wolters Kluwer 2007, used with permission.]

- (a) Label the artery and the vein. [1]
- (b) Describe **one** characteristic of the artery and vein which helped you to identify them. [1]

Artery: .....

Vein: .....

*(This question continues on the following page)*



(Question 2 continued)

- (c) (i) The coronary artery carries oxygen to the tissues in the wall of the heart. State how this oxygen enters the blood. [1]

.....  
.....

- (ii) The blood carried by arteries and veins contains antibodies. Explain antibody production by lymphocytes. [3]

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

- (iii) State a substance, other than oxygen and antibodies, carried by both arteries and veins. [1]

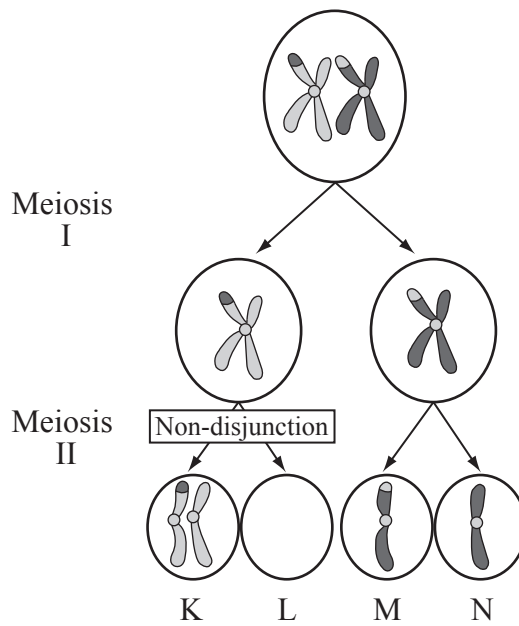
.....  
.....

- (d) Calculate the actual size of the vessel shown by the line XY. [1]

.....



3. The diagram shows the meiotic division of chromosome pair 21 in humans.



(a) (i) State the name of the event that has led to the difference in appearance of gametes M and N. [1]

.....

(ii) State the total number of chromosomes the gamete will have in K and L. [2]

K: .....

L: .....

(iii) State the genetic condition that arises when gamete K is fertilised by a normal gamete. [1]

.....

.....

(This question continues on the following page)





(Question 3 continued)

- (b) (i) Determine the possible genotypes of the offspring of a woman who is a carrier for colour blindness and a man with normal colour vision using the Punnett square. [2]

Gametes	.....	.....
.....	.....	.....
.....	.....	.....

- (ii) Deduce the probability of this couple having a colour blind daughter. [1]

.....

- (iii) The first child of this couple was a colour blind son. Deduce the probability that the next child will be a colour blind son. [1]

.....

- (c) Explain how sickle cell anemia is caused. [3]

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



**SECTION B**

*Answer one question. Up to two additional marks are available for the construction of your answer. Write your answers in the boxes provided.*

4. (a) Draw and label a diagram of the carbon cycle. [6]
- (b) Outline the effect of carbon dioxide concentration on the rate of photosynthesis and how this can be measured by carbon dioxide uptake. [4]
- (c) Explain how carbon dioxide is produced in anaerobic and in aerobic respiration. [8]
5. (a) Draw and label a diagram to show the structure of membranes. [6]
- (b) Distinguish between eukaryotic and prokaryotic cells. [4]
- (c) Explain how vesicles are used to transport proteins within a eukaryotic cell. [8]
6. (a) Draw a labeled diagram of the female reproductive system. [6]
- (b) Discuss the ethical issues associated with IVF. [8]
- (c) Describe the application of DNA profiling to determine paternity investigations. [4]



A large rectangular area containing horizontal dotted lines for writing.



16EP11

Turn over





A large rectangular box containing numerous horizontal dotted lines, designed for writing answers.



A large rectangular area containing horizontal dotted lines, intended for writing answers.



A large rectangular area containing 30 horizontal dotted lines, intended for handwritten responses.

