SL Paper 3

a. Outline the symptoms of type II diabetes. [2]

b. Explain the dietary advice that should be given to a patient who has developed type II diabetes. [3]

b. State **one** symptom of type II diabetes. [1]

c. Explain the dietary advice that should be given to a patient who has developed type II diabetes. [3]

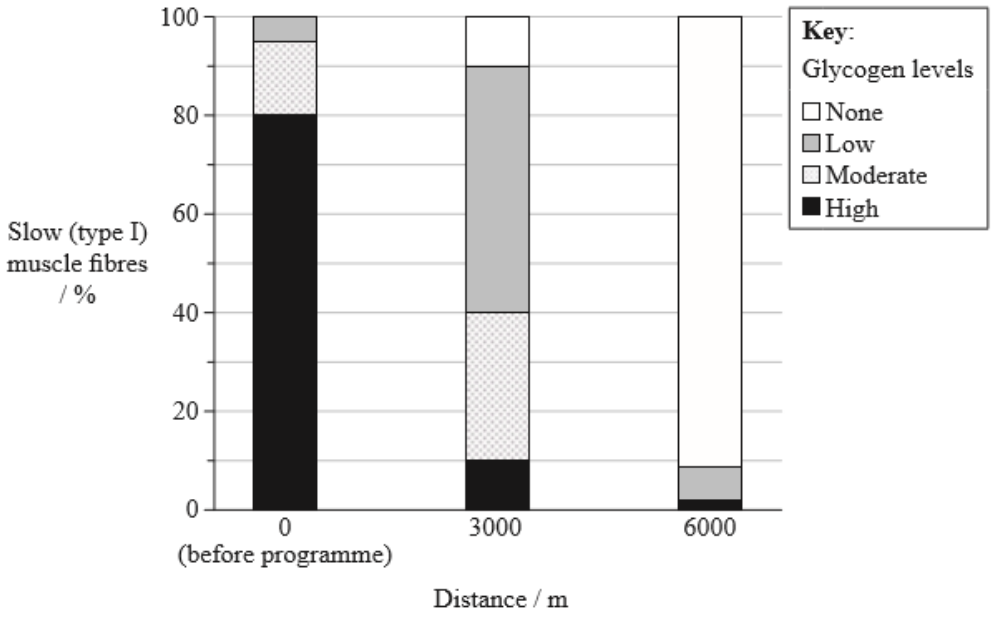
An investigation was conducted among competitive swimmers to determine the effects of two different training programmes.

3000 m programme: 6×500 m front crawl swims with 1-minute rests between each swim

6000 m programme: 60×100 m front crawl swims with 20-second rests between each swim

Swimmers were encouraged to maintain an even pace throughout the programmes. The pace was slightly slower in the 3000 m programme than in the 6000 m programme.

Tissue samples were taken from the shoulder muscle of each swimmer, before and after each session. Glycogen levels were analysed in slow (type I) muscle fibres.



[Source: adapted from D H Costill, *et al.*, (1988), *Journal of Swimming Research*, **4**(1), pages 13–18. Used with the author's permission.]

a. Calculate the percentage of slow (type I) muscle fibres that contain low levels of glycogen after the 3000m programme. [1]

b. State the effect of the 3000 m programme on glycogen levels in slow (type I) muscle fibres. [1]

c (i) Compare the effects of the 3000 m programme with the 6000 m programme on muscle glycogen levels. [2]

c (ii) Suggest reasons for the differences between the 3000 m programme and the 6000m programme in their effects on muscle glycogen levels. [2]

d. Suggest **one** limitation of the data. [1]

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a. Draw a labelled diagram of a sarcomere. [3]

b. Explain the role of calcium ions in muscle contraction. [2]

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a. State **one** consequence of protein deficiency malnutrition. [1]

b. Outline the reasons for increasing rates of clinical obesity in some countries. [3]

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a. Outline the control mechanism for appetite in humans. [2]

b. Explain the possible health consequences of a diet rich in protein. [3]

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a . State two symptoms of type II diabetes. [2]

b. Explain the causes and consequences of phenylketonuria (PKU). [4]

Describe the effects of training on the pulmonary system.

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a. Define *tidal volume* and *ventilation rate*. [2]

Tidal volume:

Ventilation rate:

b. Explain the processes that control changes in ventilation rate during exercise. [4]

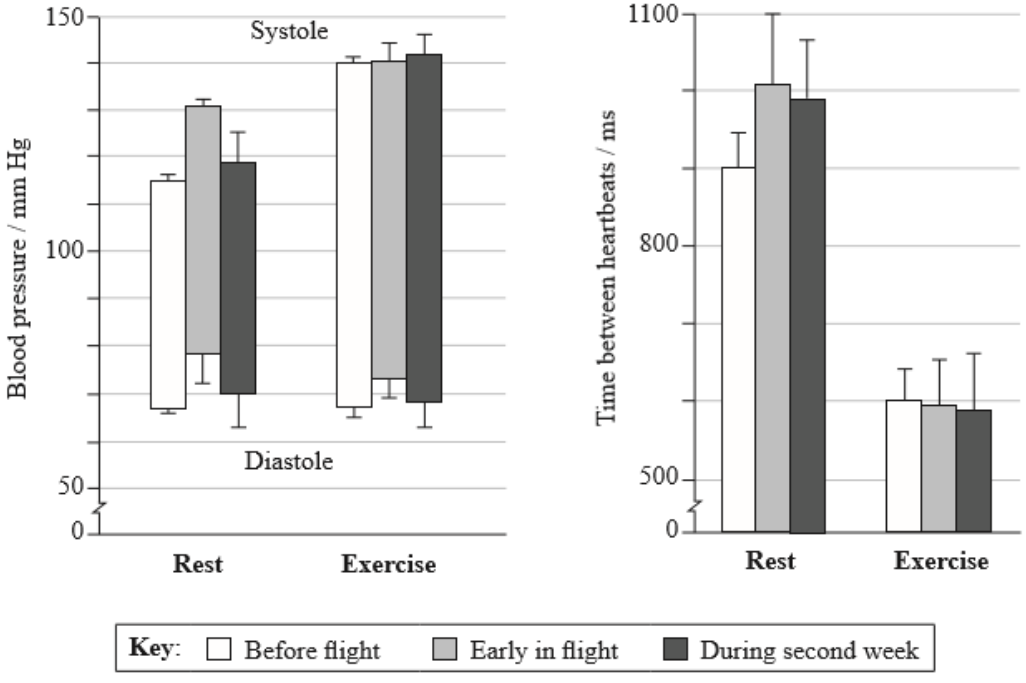
b (i) State the role of ligaments in human movement. [1]

d. Explain the changes in ventilation rate during exercise. [2]

List **two** reasons for increases in the rate of clinical obesity.

1. .....
2. .....

Scientists investigated astronauts' cardiovascular response to exercise in weightless conditions during a Columbia Space Shuttle mission. They measured the blood pressure and the time between heartbeats, both at rest and during moderate exercise. Blood pressure is expressed by two values corresponding to ventricular contraction (systole) and relaxation (diastole). Measurements were taken before the flight, early in the flight and during the second week in space. The following graphs represent average values for each type of measurement.



[Source: *Journal of Applied Physiology*, M. Di Rienz et al.,105, 2008, pages 1569–1575.]

a. Calculate the difference in blood pressure at systole between rest and exercise before flight, giving the units. [1]

b. Outline the response of the astronauts' cardiovascular system to exercise before the flight. [2]

c. Discuss whether the cardiovascular system has to adjust to weightless conditions in space. [3]

Antibiotics are sometimes given orally to poultry to prevent disease that may lead to reduced growth. Antibiotic resistance of bacteria from turkeys and chickens bred for meat and from egg laying hens was measured.

Excrement was collected and *Escherichia coli* bacteria were isolated. These bacteria were tested for resistance to a range of antibiotics and the results are shown below.

Number of antibiotics to which *E. coli* are resistant	Turkeys $n = 43$	Chickens $n = 45$	Egg laying hens $n = 20$
0	7	9	13
1	8	5	3
2	7	7	0
3	2	7	3
4	5	7	1
≥5	14	10	0

[Source:Antibiotic resistance of faecal _Escherichia coli_ in poultry, poultry farmers and poultry slaughterers. A. E. van den Bogaard, N. London, C. Driessen, E. E. Stobberingh. _Journal of Antimicrobial Chemotherapy_, 47, June 1, 763--771. 2001, Oxford University Press.]

a. Calculate the percentage risk of bacteria becoming resistant to more than five kinds of antibiotics in turkeys and egg laying hens. [1]

Turkeys:

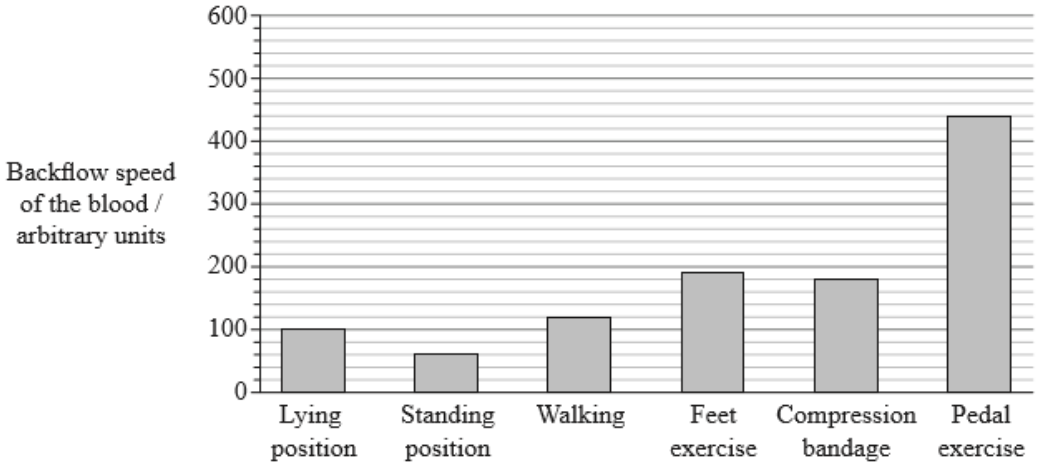
Egg laying hens:

b. Compare the incidence of drug resistance in bacteria from chickens and egg laying hens. [2]

c. Discuss the hypothesis that giving antibiotics increases antibiotic resistance in poultry bacteria. [2]

d. Suggest how antibiotic-resistant bacteria are passed from animals to humans. [1]

Backflow is the return of blood to the heart. In legs, backflow is enhanced by the pumping action of leg muscles during movement. When this does not occur efficiently, serious health problems can arise. The backflow speed of 40 patients was measured during the application of different therapy methods. The lying position is the control.



[Source: adapted from postdoctoral thesis of Erich Meyer, Medical faculty of the University of Erlangen-Nürnberg]

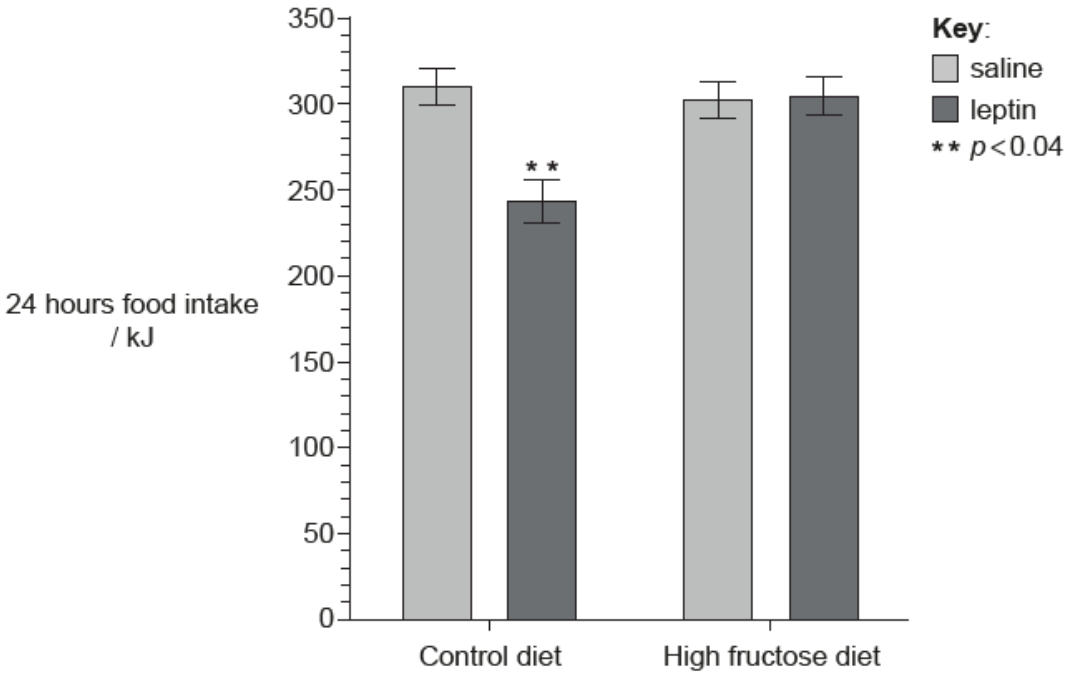
a (i) State which activity reduces backflow speed in relation to the control. [1]

a (ii) Suggest a reason why backflow speed is reduced by the activity stated in (a)(i). [1]

b. Determine the difference in backflow speed between the lying position and pedal exercise. [1]

c. Discuss the benefits of exercising to promote high backflow speed. [3]

In an experiment to determine the effect of diet on response to leptin, mice were fed a control diet or a high fructose diet for six months and then either injected with a saline (salt) solution or injected with leptin. The food intake of both groups was then monitored over a 24 hour period.



[Source: adapted from A Shapiro, *et al*., (2008),
The American Journal of Physiology – Regulatory, Integrative and Comparative Physiology, **295**(5), R1370–R1375]

Leptin is a hormone. Hormones are chemicals produced in one part of the body that have an effect in another part of the body.

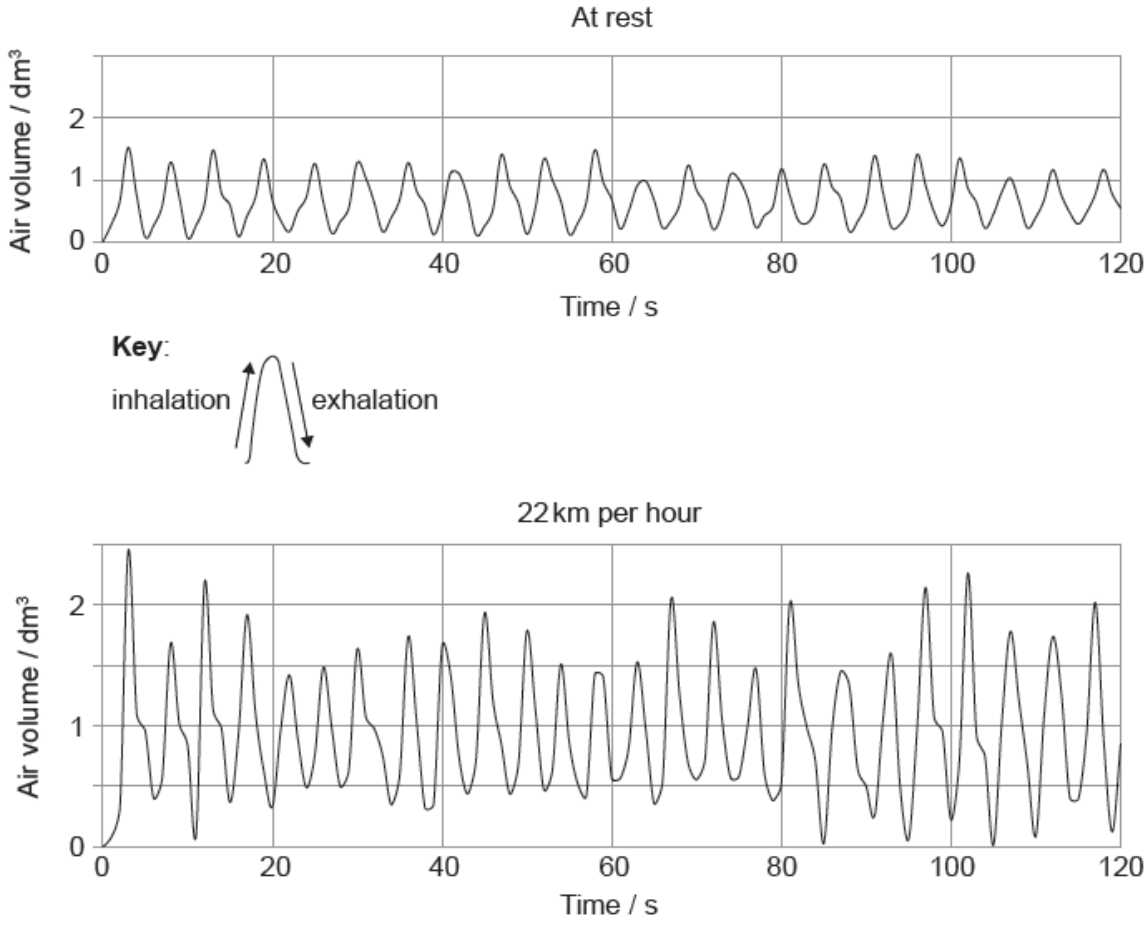
a. Distinguish between the effect of leptin injection on 24 hour food intake in the mice fed the control diet and in the mice fed the high fructose diet. [1]

b. Discuss the implications of these results for recommending leptin injections as an appetite suppressant for humans. [2]

c.i. State the tissue that produces leptin in humans. [1]

c.ii. State the target that leptin normally acts on. [1]

A spirometer was used to measure the ventilation rate of a person at rest and pedaling at 22 km per hour on an exercise bike.



a. Calculate the difference in ventilation rate between resting and exercising. [1]

b. Explain the change in the tidal volume during exercise. [3]

The micrograph shows a transverse section through blood vessels of a mammal.

[Source: This book was originally published by OpenStax College, released under the CC-By license: https://creativecommons.org (https://creativecommons.org/) The eBook was adapted by Frank Lee.]

a. Identify the vein by labelling it with the letter V. [1]

b. Distinguish between the vein and the artery with reference to structures visible in the micrograph. [2]