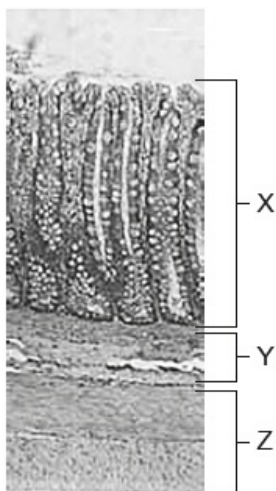


Exam Prep 6 [46 marks]

1. The photomicrograph shows a section through a human small intestine. [1 mark]



[Source: Chiodini RJ, Dowd SE, Chamberlin WM, Galandiuk S, Davis B, Glassing A (2015) Microbial Population Differentials between Mucosal and Submucosal Intestinal Tissues in Advanced Crohn's Disease of the Ileum. *PLoS ONE* 10(7): e0134382. [https://doi.org/10.1371/journal.pone.0134382.](https://doi.org/10.1371/journal.pone.0134382)]

Which statement corresponds to the labelled structures?

- A. X moves food along the intestine.
- B. Y is the mucosa.
- C. Y contains lacteals.
- D. Z causes peristalsis

2. What feature of arteries is most important in maintaining sufficiently high *[1 mark]* blood pressure?
- A. A wide lumen
 - B. Elastic fibres in the wall
 - C. Valves at intervals
 - D. A thin wall

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3. What is a feature of phagocytic white blood cells? *[1 mark]*
- A. Stimulate blood clotting
 - B. Found only in the circulatory system
 - C. Form part of non-specific immunity
 - D. Produce antibodies

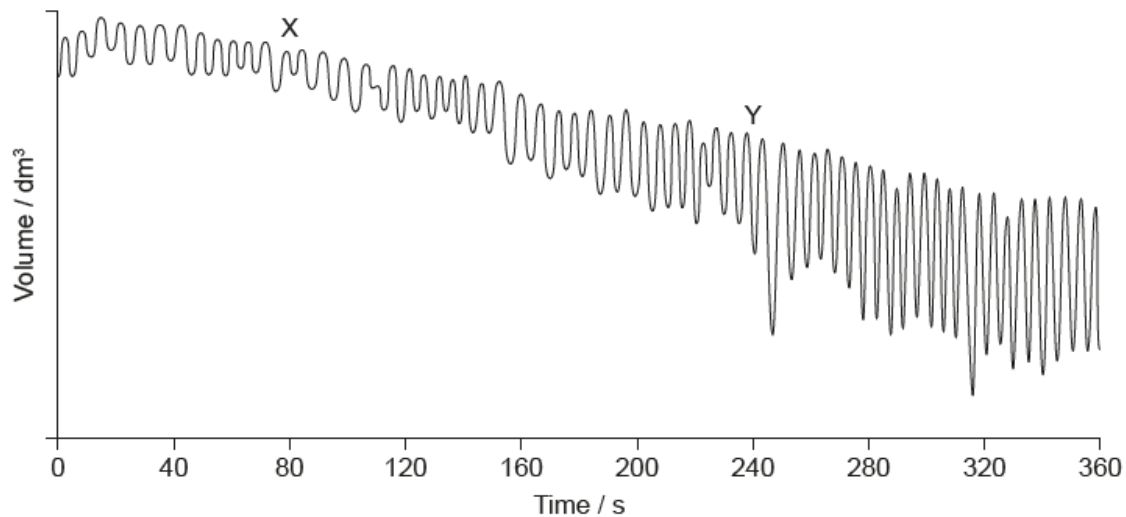
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5. The graph shows a spirometer trace of oxygen consumption when breathing at rest and during exercise.

[1 mark]



[Source: Courtesy of Dr. Dafang Wang for his work at University of Utah.]

What explains the difference between the traces at regions X and Y on the graph?

- A. At X, the internal intercostal muscles contract more than the external intercostal muscles.
- B. At Y, the ribcage moves up and out more than at X.
- C. At X, the diaphragm flattens more per breath than at Y.
- D. At Y, the intercostal muscles contract more slowly than at X.

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6. How do neonicotinoid pesticides cause paralysis and death in insects? [1 mark]

- I. Acetylcholine receptors are blocked.
- II. Cholinesterase fails to break down the pesticide.
- III. The pesticides bind to presynaptic receptors.

- A. I only
- B. I and II only
- C. I and III only
- D. I, II and III

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7. A female is overweight, feels cold and tired, and often fails to ovulate during the menstrual cycle. Which two hormones are probably secreted at insufficient levels? [1 mark]

- A. Estrogen and FSH
- B. LH and thyroxin
- C. Insulin and glucagon
- D. Epinephrine and leptin

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A study was conducted to look at the short-term effects of a change in diet on the risk of disease in young adults. The table shows data on the habitual diet of the participants as well as the study diet followed for two weeks.

	Mean daily intake ± standard deviation	
	Habitual diet	Study diet
Energy / kJ	10 143±949	9992±479
Fat / g	100±6	99±5
Saturated fat / % total fat	37±2	60±1
Unsaturated fat / % total fat	63±2	40±1
Monounsaturated fat / % total fat	46±1	32±1
Polyunsaturated fat / % total fat	17±1	8±1
Carbohydrate / g	248±23	232±16
Protein / g	119±12	120±9

[Source: Horowitz, J.F., Ortega, J.F., Hinko, A., Li, M., Nelson, R.K. and Mora-Rodriguez, R., 2018. Changes in markers for cardio-metabolic disease risk after only 1-2 weeks of a high saturated fat diet in overweight adults. *PLoS ONE*, 13(6), e0198372.]

8a. Comment on the total energy content of the two diets. [1 mark]

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8b. Distinguish between the two diets. [2 marks]

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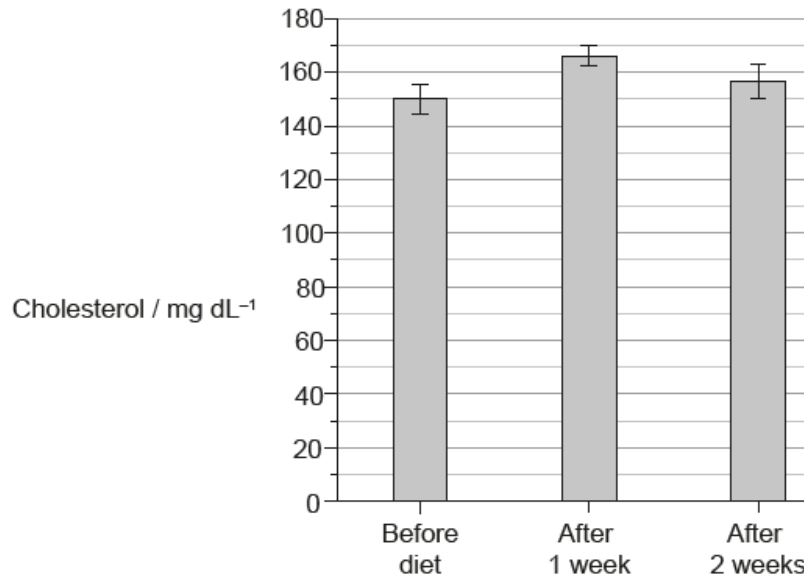
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Total blood plasma cholesterol levels were measured before the study began and once a week after starting the study diet. Mean results are shown in the bar chart, including the standard deviation.

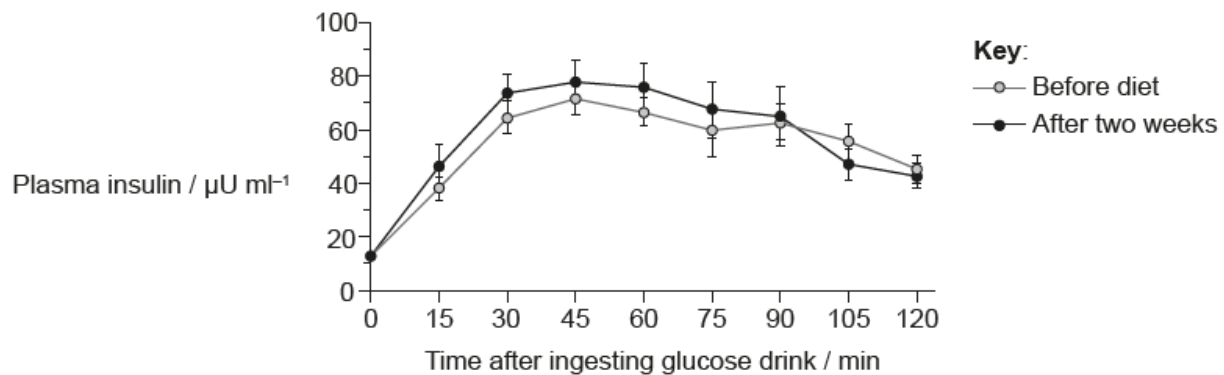


[Source: Horowitz, J.F., Ortega, J.F., Hinko, A., Li, M., Nelson, R.K. and Mora-Rodriguez, R., 2018. Changes in markers for cardio-metabolic disease risk after only 1-2 weeks of a high saturated fat diet in overweight adults. *PLoS ONE*, 13(6), e0198372.]

- 8c. Calculate, showing your working, the percentage change in mean cholesterol level after **one week** on the study diet. [2 marks]

.....%

Control of blood glucose concentration was investigated using an oral glucose tolerance test. For this test, the person was given a concentrated glucose drink (at time zero) and then blood samples were taken every 15 minutes to determine the plasma insulin level. This test was done before the study diet and after two weeks on the study diet. Mean results are shown in the graph, including the standard deviation.



[Source: Horowitz, J.F., Ortega, J.F., Hinko, A., Li, M., Nelson, R.K. and Mora-Rodriguez, R., 2018. Changes in markers for cardio-metabolic disease risk after only 1-2 weeks of a high saturated fat diet in overweight adults. *PLoS ONE*, 13(6), e0198372.]

8d. Compare the data for plasma insulin levels before and after the study diet. [2 marks]

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8e. State which cells secrete insulin. [1 mark]

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8f. Outline the reason for plasma insulin levels changing in the first 30 minutes of the test. [1 mark]

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8g. The hypothesis made before the study was that saturated fats in the diet affected the risk of coronary artery blockage and diabetes. Using all the data in question 1, evaluate whether this hypothesis is supported by the study. [3 marks]

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9a. Outline how the amphipathic properties of phospholipids play a role in membrane structure. [2 marks]

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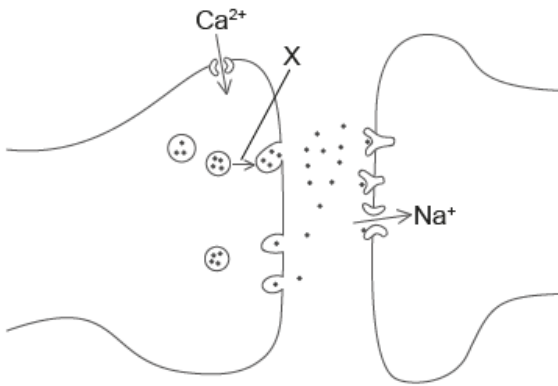
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The diagram shows part of two neurons.



[Source: © International Baccalaureate Organization 2020.]

9b. State the name of the structure shown.

[1 mark]

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9c. X indicates the movement of a structure in the neuron. Explain what events trigger this movement and what happens next.

[3 marks]

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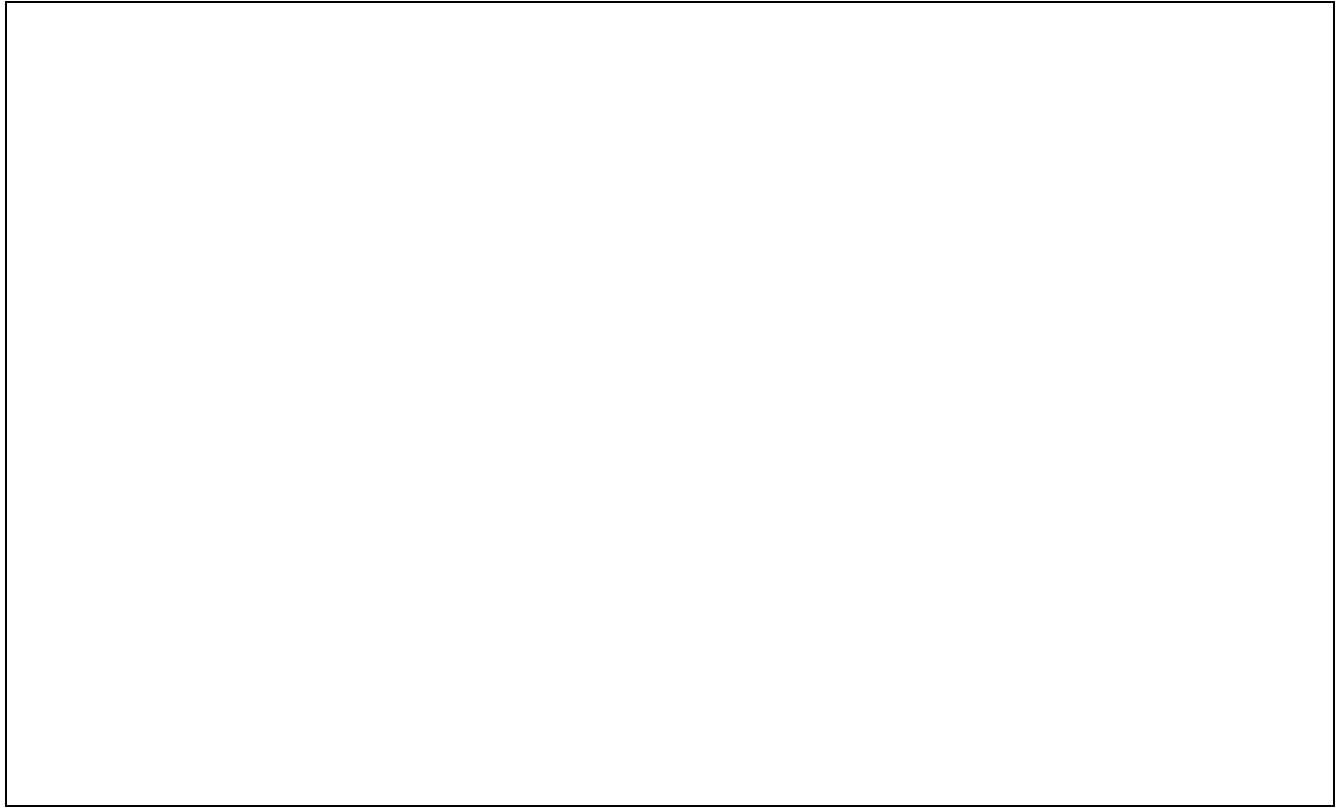
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According to the cell theory, living organisms are composed of cells.

10a. Draw the ultrastructure of a prokaryotic cell based on electron micrographs.

[3 marks]



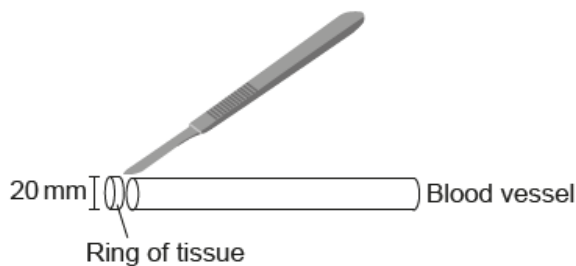
10b. Outline what occurs in cells in the first division of meiosis.

[5 marks]

[illegible]

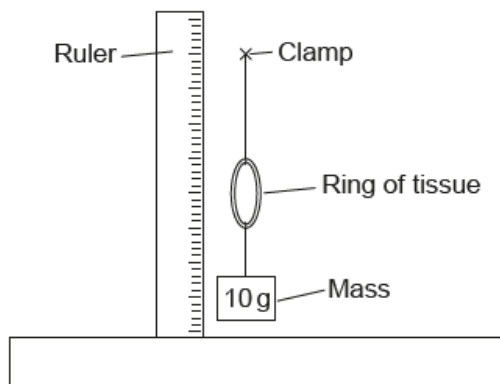
[7 marks]

In an investigation to compare the elasticity of arteries and veins, rings of the same diameter (20 mm) of artery and vein tissue were cut from blood vessels obtained from a mammal.



[Source: © International Baccalaureate Organization 2020.]

Each ring was attached to a clamp. Multiple masses of 10 g were added and removed. The vertical diameter of the artery and the vein was measured, both with the mass and once the mass had been removed.



The results are shown in the table.

Mass / g	Diameter of vein / mm		Diameter of artery / mm	
	With mass	Mass removed	With mass	Mass removed
0	20	20	20	20
10	26	26	26	22
20	34	33	30	23
30	38	36	35	23
40	40	37	38	24

11a. State the independent and dependent variables in this experiment. [2 marks]

Independent:

Dependent:

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11b. State **one** feature of the rings that has to be kept constant apart from their initial diameter. [1 mark]

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11c. Explain the differences between the results shown for vein and artery. [3 marks]

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