

A Level Biology A
H420/01 Biological Processes

Question Set 16

16 (a) (i) Fig. 16 shows pressure changes during the cardiac cycle.

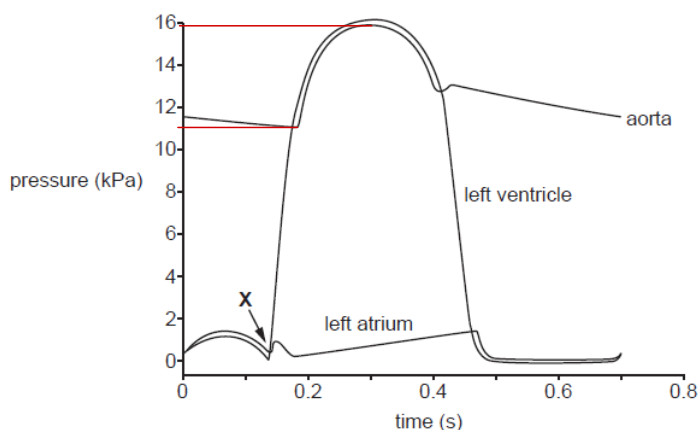


Fig. 16

Using Fig. 16, compare the changes in pressure in the left ventricle with the changes in pressure in the left atrium. [4]

Pressure in the left atrium is generally low because the thin walls of the atrium cannot generate much force. Atrial pressure is highest during atrial systole (~1kPa, ~0.07s) as the walls of the left atrium contract, but decreases after the bicuspid valve closes. During atrial systole, there is a slight rise in pressure of the left ventricle as blood enters. Pressure in the left ventricle rises dramatically as the thick muscular walls of the ventricle contract during ventricular systole. Whilst the maximum pressure reached is ~1kPa in the left atrium, the left ventricle reaches pressures of up to 16kPa. As pressure in the ventricle exceeds that in the aorta, blood exits the ventricle via an open semi-lunar valve, causing ventricular pressure to rapidly fall. Atrial and ventricular pressure remain low during diastole

16 (a) (ii) Using Fig. 16, calculate the heart rate of this individual.

Give your answer to 2 significant figures.

1 cardiac cycle in 0.7s heart rate = 86 beats/min [1]

$$\frac{60}{0.7} \times 1 = 86 \text{ beats/min}$$

16 (a) (iii) Using Fig. 16, calculate the percentage change between minimum and maximum pressure in the aorta.

Give your answer to 2 significant figures.

$\frac{16-11}{11} \times 100 = 45\%$ percentage change = 45% [2]

16 (a) (iv) Name the valve which closes at point X on Fig. 16. [1]

Bicuspid valve

16 (b) The heart supplies oxygenated blood to the tissues.

VO_2^{\max} is a measurement of the maximum volume of oxygen that an individual can use during intense exercise in a given time.

Smart watches can estimate the VO_2^{\max} of an individual by measuring heart rate while exercising.

Having a higher VO_2^{\max} is associated with improved aerobic fitness.

Two male students exercised for 30 min and used smart watches to record their VO_2^{\max} .

Table 16 shows their masses and the VO_2^{\max} values they recorded.

Student	Mass (kg)	VO_2^{\max} ($\text{cm}^3 \text{ kg}^{-1} \text{ min}^{-1}$)
1	65	50.4
2	57	48.2

Table 16

Student 1 drew the following conclusion from this result:

My VO_2^{\max} is higher because my mass is greater. I have more cells than Student 2. Each cell needs oxygen to carry out

Student 2 said that this conclusion is invalid because several variables have not been controlled.

State **three** variables necessary for a valid comparison that have **not** been controlled in the above experiment.

Age of the students, type and intensity of exercise, environmental temperature when exercising. [3]

16 (c) Brown fat is a type of tissue.

Brown fat has a higher need for oxygen because fat cells in this tissue carry out aerobic respiration at a higher rate than fat cells in other tissues.

Suggest which organelle is present in higher numbers in brown fat cells than in other fat cells.

Mitochondria [1]

Total Marks for Question Set 16: 12

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