

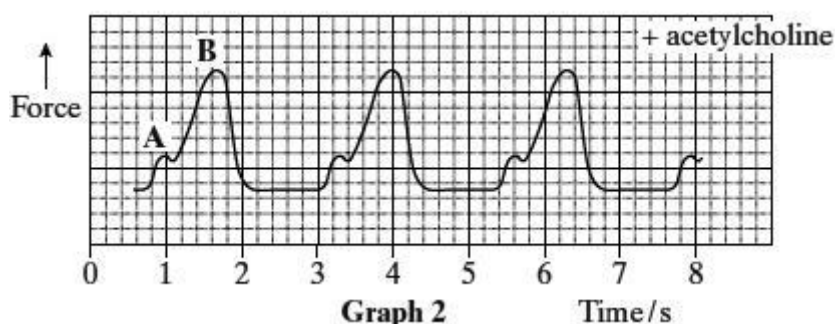
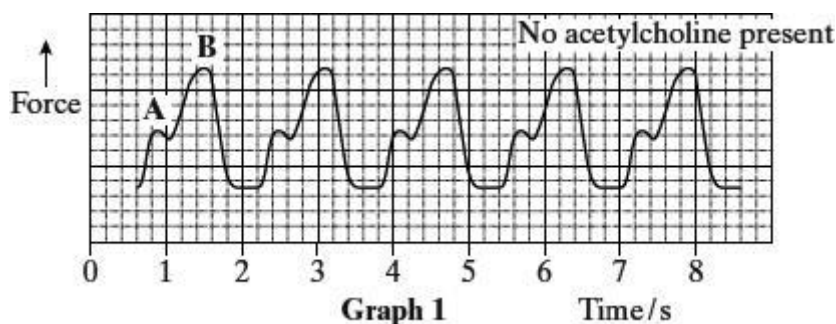
Name of the Student: _____

Max. Marks : 24 Marks

Time : 24 Minutes

Q1.

A frog's heart was attached to an instrument which measured the force produced as the heart contracted. **Graph 1** shows the changes in force when the heart was bathed in a solution of salts at 20 °C. **Graph 2** shows the results when the heart was bathed in the same solution at the same temperature, but including acetylcholine.



- (a) Points **A** and **B** show when the atria and ventricle were contracting. Which point, **A** or **B**, shows contraction of the ventricle? Give **two** reasons for your answer.

Point _____

Reason 1 _____

Reason 2 _____

(2)

- (b) Calculate the frog's heart rate when acetylcholine was **not** present. Show your working.

Heart rate = _____ beats per minute.

(2)

- (c) (i) From the graphs, what can you conclude about the effect of acetylcholine on heart rate;

stroke volume?

(2)

- (ii) Use your answer to part (i) to explain the effect of acetylcholine on cardiac output.

(1)

- (iii) Addition of acetylcholine in the experiment mimics the effect of one branch of the autonomic nervous system. Which branch is this?

(1)

- (d) (i) Explain how nervous control in a human can cause increased cardiac output during exercise.

(4)

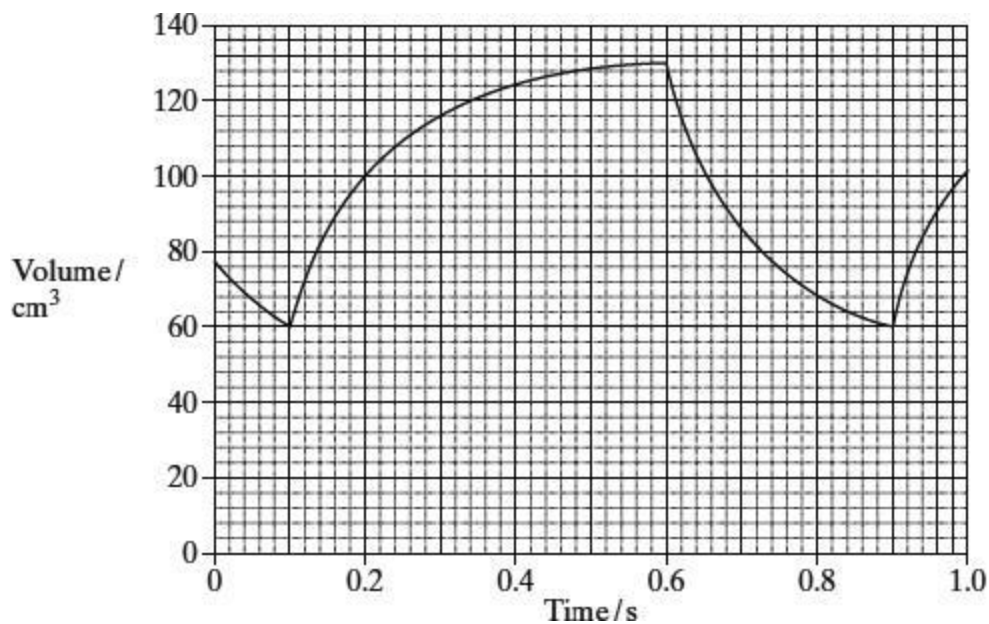
- (ii) Explain why increased cardiac output is an advantage during exercise.

(3)

(Total 15 marks)

Q2.

The graph shows changes in the volume of blood in the left ventricle.



- (a) Between which times is the left *atrium* contracting? Give the evidence from the graph that supports your answer.

Times _____

Evidence _____

(2)

- (b) Use the graph to calculate.

- (i) the heart rate;

Answer _____

(2)

- (ii) stroke volume.

Answer _____

(1)

- (c) Describe how you would calculate cardiac output from heart rate and stroke volume.

The table shows the rate of blood flow to some organs when a person is at rest and during a period of vigorous exercise.

Organ	Rate of blood flow / $\text{cm}^3 \text{ minute}^{-1}$	
	at rest	during exercise
Skeletal muscles	1 000	16 000
Kidney	1 200	1 200
Brain	750	
Heart muscle	300	1 200

- (d) Suggest a value for the rate of blood flow to the brain during exercise.

(1)

- (e) (i) The coronary arteries take blood to the muscles in the wall of the heart. Calculate the ratio of the rate of blood flow into the coronary arteries during exercise to the rate flowing into these arteries at rest.

Answer _____

(1)

- (ii) At rest the rate of flow of blood to the heart muscle is $0.9 \text{ cm}^3 \text{ g}^{-1}$ per minute. Calculate the volume of blood 1g of heart muscle would receive in 5 minutes of vigorous exercise.

Answer _____

(1)

(Total 9 marks)