St Dominic's Sixth Form College

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<u>A Level Physical Education Transition Work 2026-27</u>

The work that you have been set to complete over the summer has been purposely designed to ensure retention of prior knowledge (or help bridge some of the gaps if you haven't done GCSE PE) and to allow for preparation of the challenges of A Level PE. By completing these tasks, you will be well prepared to start the A Level in PE and will have looked at key content relevant to the course.

<u>Task 1- Seneca Learning</u>

Approximate completion time: 130 minutes

You have been set an assignment on Seneca learning that you need to complete before the **<u>25th of August 2026 by 3pm</u>**. This is to revise and consolidate some of the work that you may have covered at GCSE. It will help you be ready for the A level content.

Many of you will have used Seneca learning for your GCSE work. Click on the following link:

https://app.senecalearning.com/dashboard/class/ww97nxrjo4/assignments/assignment/062511c2-eb29-4be7-934d-0a90adc125a2

If you already have an account, you can join the class with the code: **ww97nxrjo4**

Otherwise, you will be asked to create an account, which you can do using your personal email. The assignment can be started and come back to at different times, so you don't need to do it all in one go.

You can also scan the QR code below with your phone to take you to the assignment:

<u>Task 2-Flipped Learning</u>

Approximate completion time: 30-45 minutes

Due to the vast amount of content on the A Level in Physical Education, before each lesson, you will need to pre-read/learn the information for the next lesson, so that we can focus on applying and evaluating that knowledge in class, rather than having to start with learning the knowledge. With this in mind, you will need to read the following three and a half pages of information and make concise revision notes by hand. The revision notes can be in the form of flashcards, spider-diagrams, or another method that works for you. You will hand this into me during our first workshop lesson.

The impact of physical activity on stroke volume, heart rate and cardiac output

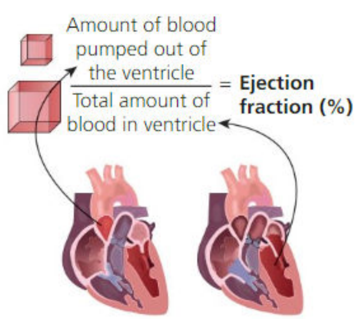
During exercise, the need to transport more oxygen to the working muscles means the heart has to work harder. This means that more blood is pumped around the body and faster. Measurements such as **stroke volume**, heart rate and cardiac output all have to change as a result.

Stroke volume

This is the volume of blood pumped out by the heart ventricles in each contraction. On average, the resting stroke volume is approximately 70ml.

Stroke volume depends upon the following:

- Venous return: this is the volume of blood returning to the heart via the veins. If venous return increases, then stroke volume will also increase. (If more blood enters the heart, then more blood goes out!)
- The elasticity of cardiac fibres: this is concerned with the degree of stretch of cardiac tissue during the **diastole phase** of the cardiac cycle. The more the cardiac fibres can stretch, the greater the force of contraction will be.



$$\text{Ejection fraction} = \frac{\text{stroke volume}}{\text{end diastolic volume (volume of blood in the ventricles at rest)}}$$

Figure 3 The ejection fraction

- The contractility of cardiac tissue (myocardium): the greater the contractility of cardiac tissue, the greater the force of contraction. This results in an increase in stroke volume. It is also highlighted by an increase in the ejection fraction. This refers to the percentage of blood pumped out by the left ventricle per beat. An average value is 60 per cent, but it can increase by up to 85 per cent following a period of training.

Diastole phase: When the heart relaxes to fill with blood.

Ejection fraction: The percentage of blood pumped out by the left ventricle per beat.

Heart rate

This is the number of times the heart beats per minute. On average, the resting heart rate is approximately 72 beats per minute.

Cardiac output

KEY TERM

Cardiac output: The volume of blood pumped out by the heart ventricles per minute.

Cardiac output is the volume of blood pumped out by the heart ventricles per minute. It is equal to stroke volume multiplied by heart rate.

Cardiac output (Q) = Stroke volume (SV) × Heart rate (HR)

Q = 70 ml (see page 5) × 72

Q = 5040 ml (5.04 litres)

It can be seen from this calculation that if heart rate or stroke volume increase, then cardiac output will also increase.

Heart rate range in response to exercise

Heart rate increases with exercise but how much it increases is dependent on the intensity of the exercise. Heart rate will increase in direct proportion to exercise intensity – the higher the intensity, the higher the heart rate. Heart rate does eventually reach a maximum. Maximum heart rate can be calculated by subtracting your age from 220. An 18 year old will have a maximum heart rate of 202 beats per minute.

220 – 18 = 202

A trained performer has a greater heart rate range because their resting heart rate is lower and their maximum heart rate increases. Think of Sir Bradley Wiggins, who had a resting heart rate of 35 bpm at the peak of his cycling career, and Sir Mo Farah, who had a resting heart rate of 33 bpm at the height of his running success. These two performers will also have a higher maximum heart rate. Compare this to a 40-year-old untrained individual whose resting heart rate is 72 and their maximum heart rate is simply linked to their age, so it is 180. Their heart rate range is much lower!

The graphs opposite illustrate what happens to heart rate during maximal exercise such as sprinting and sub-maximal exercise such as jogging.

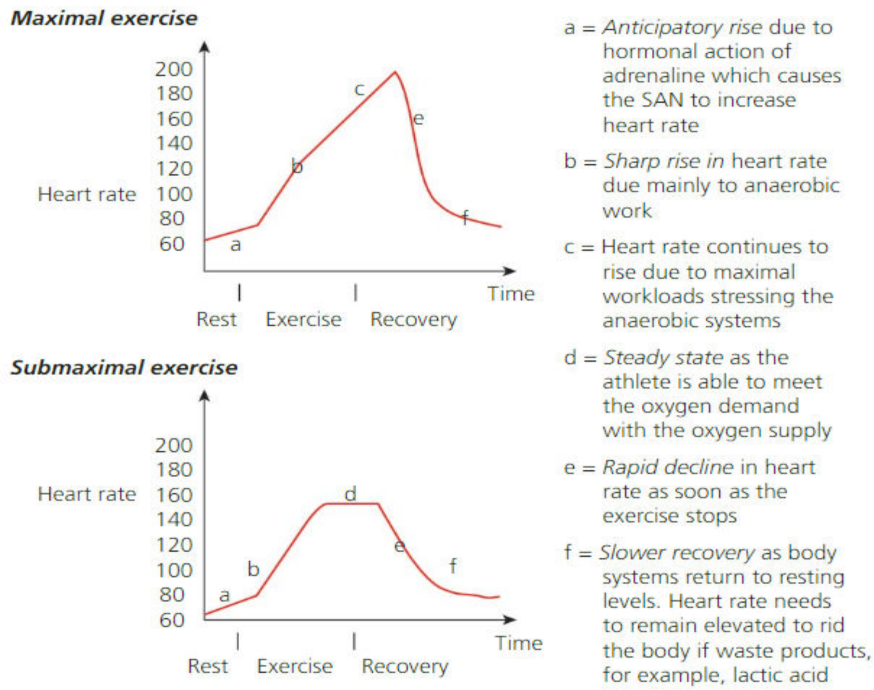


Figure 4 Heart rate responses to high intensity and submaximal exercise

Regular aerobic training will result in more cardiac muscle. When the cardiac muscle becomes bigger and stronger, this is known as **cardiac hypertrophy**. This will have an important effect on stroke volume, heart rate and therefore cardiac output. A bigger, stronger heart will enable more blood to be pumped out per beat (i.e. stroke volume). In more complex language, the end diastolic volume of the ventricle increases. If the ventricle can contract with more force and thus push out more blood, the heart does not have to beat as often, so resting heart rate will decrease. This is known as **bradycardia** and when this occurs, oxygen delivery to the muscles improves as there is less oxygen needed for contractions of the heart.

Cardiac output in response to exercise

During exercise there is a large increase in cardiac output due to an increase in heart rate and an increase in stroke volume. Cardiac output will increase as the intensity of exercise increases until maximum intensity is reached and then it plateaus (evens out) (see Figure 5).

Table 1 shows the differences in cardiac output in a trained and an untrained individual, both at rest and during exercise. The individuals in this example are aged 18 so their maximum heart rate will be 202 beats per minute.

Table 1 Cardiac output in a trained and untrained individual, both at rest and during exercise

	Stroke volume × Heart rate = Cardiac output SV × HR = Q
During exercise: Untrained person	120ml × 202 = 24.24 litres
During exercise: Trained person	170ml × 202 = 34.34 litres
At rest: Untrained person	70ml × 72 = 5.04 litres
At rest: Trained person	84ml × 60 = 5.04 litres

KEY TERMS

Cardiac hypertrophy: The thickening of the muscular wall of the heart so it becomes bigger and stronger; also can mean a larger ventricular cavity.

Bradycardia: A decrease in resting heart rate to below 60 beats per minute.

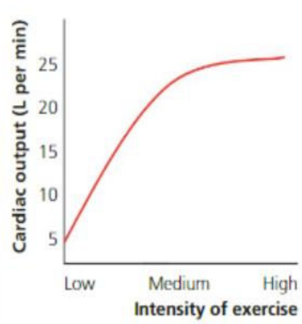


Figure 5 Graph to show cardiac output response to exercise

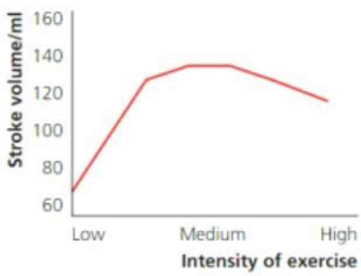


Figure 6 Graph to show stroke volume response to exercise

Memory tools

Maximum heart rate is calculated as 220 minus your age.

At rest, cardiac output for both the trained and untrained performer stays the same. It is maximum cardiac output that changes. During exercise, the increase in maximum cardiac output will have huge benefits for the trained performer as they will be able to transport more blood to the working muscles and therefore more oxygen. In addition, when the body starts to exercise, the distribution of blood flow changes. This means that a much higher proportion of blood passes to the working muscles and less passes to organs such as the intestine where it is less in demand. The amount of blood passing to the kidneys and brain remains unaltered.

Stroke volume in response to exercise

Stroke volume increases as exercise intensity increases. However, this is only the case up to 40–60 per cent of maximum effort. Once a performer reaches this point, stroke volume plateaus. One explanation for this is that the increased heart rate near maximum effort results in a shorter diastolic phase. Quite simply, the ventricles do not have as much time to fill up with blood, so they cannot pump as much out!

Task 3-Exam Question Practice

Approximate Completion Time: 10 minutes

The key to success in all A Level subjects is interpreting what the exam question is asking you. For the final task of the transition work, you will be required to try and answer some exam questions, based on the flipped learning task you have just completed. For this task to be of any value, spend some time reviewing your revision notes that you completed in task two, and set yourself ten minutes to answer the exam questions by hand on the next two pages. You will also bring this with you to your first workshop lesson with me along with the notes you have done in task two.

The table below represents heart rate and stroke volume for an untrained performer as intensity of exercise increases.

Point	Heart rate (bpm)	Stroke volume (ml)
A (rest)	70	85
B	90	90
C	100	95
D	120	100

Calculate cardiac output for the untrained performer at point **D** in the table above.

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(Total 2 marks)

The table below represents heart rate and stroke volume for an untrained performer as intensity of exercise increases.

Point	Heart rate (bpm)	Stroke volume (ml)
A (rest)	70	85
B	90	90
C	100	95
D	120	100

Explain how **and** why the components of cardiac output differ for a **trained** performer at point **A**.

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(Total 3 marks)

Paul and Mark are both 20 years old. Paul does no exercise. Mark is a cross country runner who trains three times a week.

How would maximal cardiac output differ between Paul and Mark? Justify your answer.

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(Total 3 marks)