Qualification Accredited

OCR
Oxford Cambridge and RSA

GCSE (9–1)

PHYSICAL EDUCATION

J587
For first teaching in 2016

Applied Anatomy and Physiology

1.1.e. Effects of exercise on body systems

LEARNING OUTCOMES

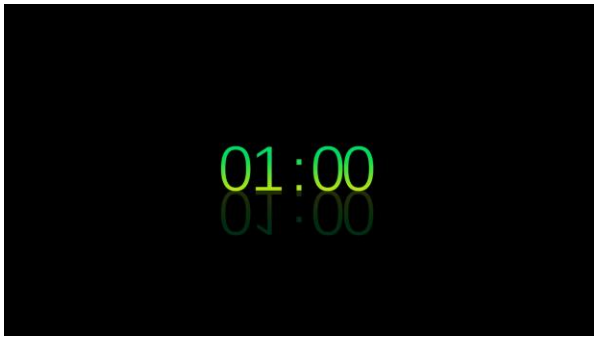
BY THE END OF THIS TOPIC YOU SHOULD BE ABLE TO …

- **Understand the short term effects of exercise**
- **Apply the effects to examples from physical activity / sport**
- **Collect and use data relating to short-term effects of exercise**
- **Understand the long-term effects of exercise**
- **Apply the effects to examples from physical activity / sport**
- **Collect and use data relating to long-term effects of exercise**

Effects of exercise on body systems

TASK: I need someone who thinks they're fit and able!

I need that person to perform as many squat thrusts (aka Burpees) as possible in 1 minute



So what did we see happen?

Effects of exercise on body systems

Short term effects of exercise - Muscles

The short term effects of exercise on the muscles:

1. Working muscles produce heat therefore **increasing muscle temperature**.

2. Increased muscle fatigue due to **lactic acid** production.

3. Blood is **re-distributed** to working muscles in an attempt to provide more oxygen to these working areas (Blood / Vascular shunting).

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Short term effects of exercise – Cardiovascular system

The **short term effects** of exercise on the cardiovascular system:

1. Increase in **heart rate**
2. Increase in **stroke volume**
3. Increase in **cardiac output**

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Short term effects of exercise – Cardiovascular system

Increase in heart rate

As we start exercising heart rate increases and beats with greater force.

Heart rate is increase by the body releasing **adrenaline** – the hormone that signals the heart to pump faster and harder. It also triggers the release of glycogen from the liver.

Exercise makes the body work harder and therefore **muscles** require more **oxygen** to continue to work effectively.

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Short term effects of exercise – Respiratory system

The **short term effects** of exercise on the respiratory system:

1. Increase in **respiratory rate**
2. Increase in **minute ventilation**
3. Increase in **tidal volume**

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Short term effects of exercise – Respiratory system

Increase in depth and frequency of breathing

Exercise causes an

increase in breathing rate

and

depth of breathing

Breathing rate can increase up to 50 per minute!!

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LEARNING OUTCOMES

BY THE END OF THIS TOPIC YOU SHOULD BE ABLE TO …

- **Understand the long-term effects of exercise on:**
  - Bone density
  - Hypertrophy of muscle
  - Muscular strength
  - Muscular endurance
  - Resistance to fatigue
  - Hypertrophy of the heart
  - Resting heart rate and resting stroke volume
  - Cardiac output
  - Rate of recovery
  - Aerobic capacity
  - Respiratory muscles
  - Tidal volume and minute volume during exercise
  - Capilliarisation
- **Apply the effects to examples from physical activity / sport**
- **Collect and use data relating to long-term effects of exercise**

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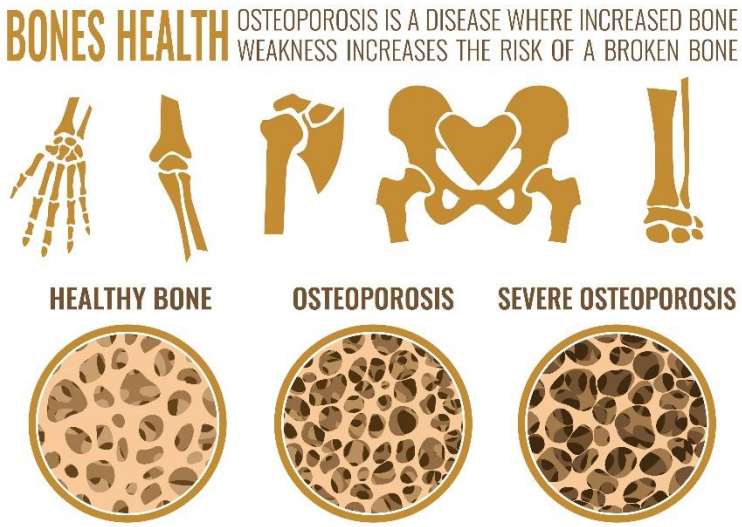
Increased bone density

Regular training will increase bone density & strengthen bone matter helping to reduce the risk of Osteoporosis



Regular weight-bearing exercise can help to maintain bone density and strength.
Weight-bearing exercise can include :

- **Skipping**
- **Running up and down stairs**
- **Jumping**

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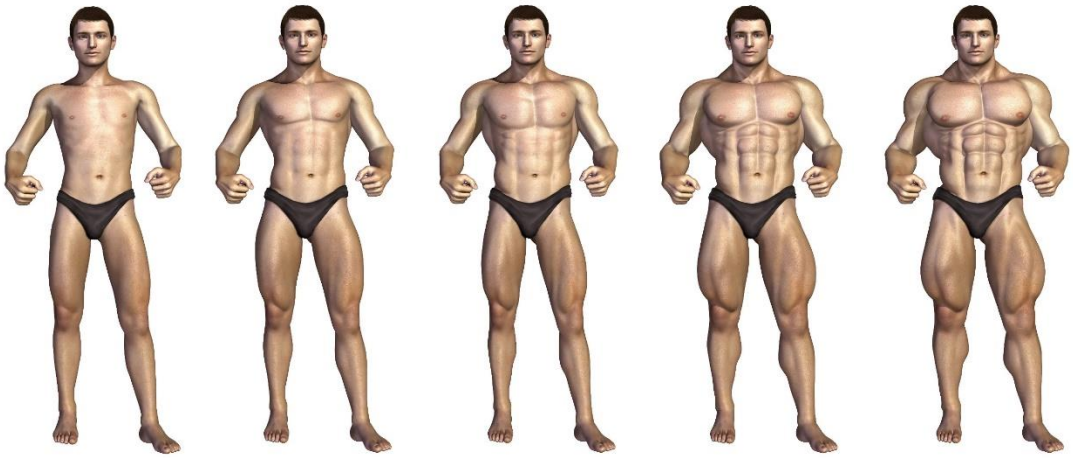
HYPERTROPHY of MUSCLE

HYPERTROPHY is an increase in the size of muscle(s).

Training results in skeletal muscle being damaged as the tiny muscle fibers are pulled apart causing trauma.

With **REST** and time to **RECOVER** these muscle fibers are re-built stronger than before.

1. Muscle hypertrophy will occur when training with heavy weights with low reps, increasing muscle size and strength.
2. Low weights, many reps will improve muscle tone and stamina.
3. Tendons, ligaments and posture will also improve.



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STRENGTH

Following resistance training there is an increase in the thickness of muscle fibres due to greater muscle protein.

Muscle *STRENGTH* will therefore be increased along with strength of tendons.

Effects of exercise on body systems

MUSCULAR ENDURANCE

Following endurance (stamina) training, muscular endurance increases.

Slow twitch fibres will get larger by about 20%.

This means that there is greater potential for energy production.

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Resistance to Fatigue

Endurance training will also increase the capacity to carry oxygen and the athlete becomes aerobically fitter.

Effects of exercise on body systems

HYPERTROPHY of the HEART

With most training programmes the size of the heart will increase.

This increase in size is known as cardiac hypertrophy.

This will occur particularly with endurance-type exercise or training. The wall of the left ventricle becomes thicker, thus increasing the strength of contractions in the heart.

This increase in contractions will ensure more blood is delivered to the working muscles.

More blood is pumped from the heart per beat of the heart and therefore stroke volume will increase.

Cardiac output will also therefore increase during high or maximal levels of exercise.

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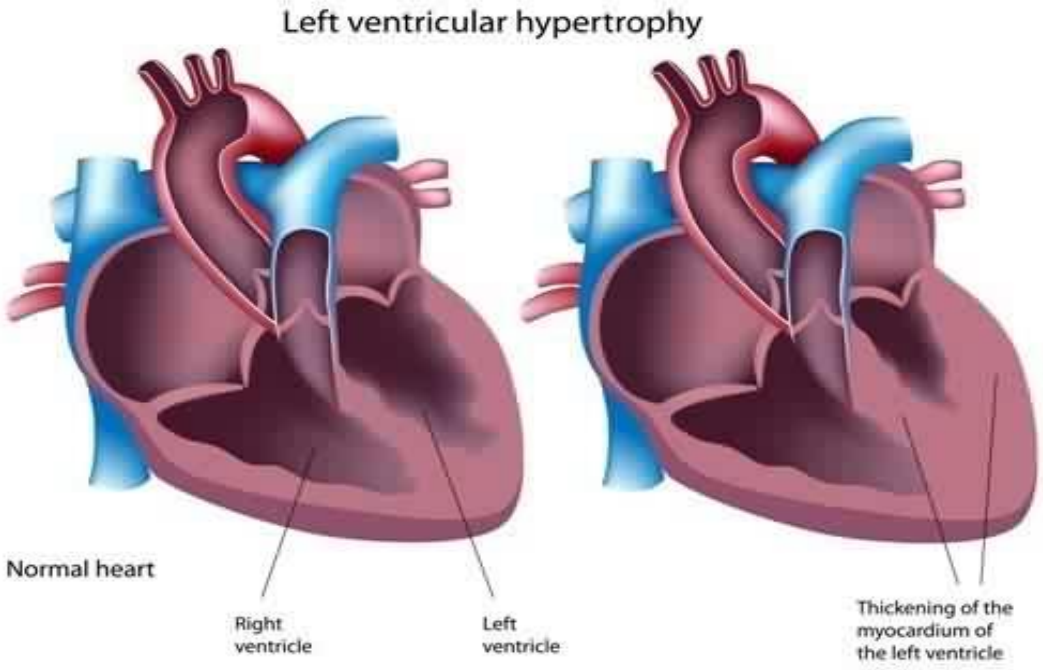
Decreased resting heart rate and Increased Stroke Volume

The increased size of the heart means it takes less beats in a minute to supply the body with enough oxygen at rest.

and

Can pump more blood with each pulse (increased STROKE VOLUME).

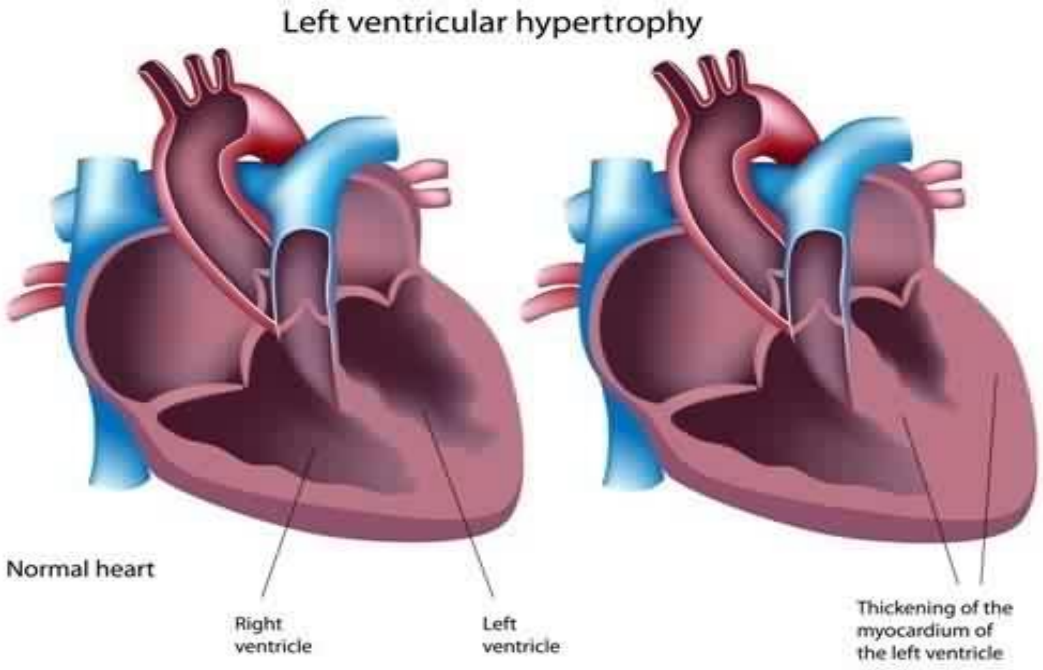


Effects of exercise on body systems

Increased Cardiac Output

As more blood is pumped from the heart per beat (Increased stroke volume).

Cardiac output will also therefore increase during high or maximal levels of exercise.



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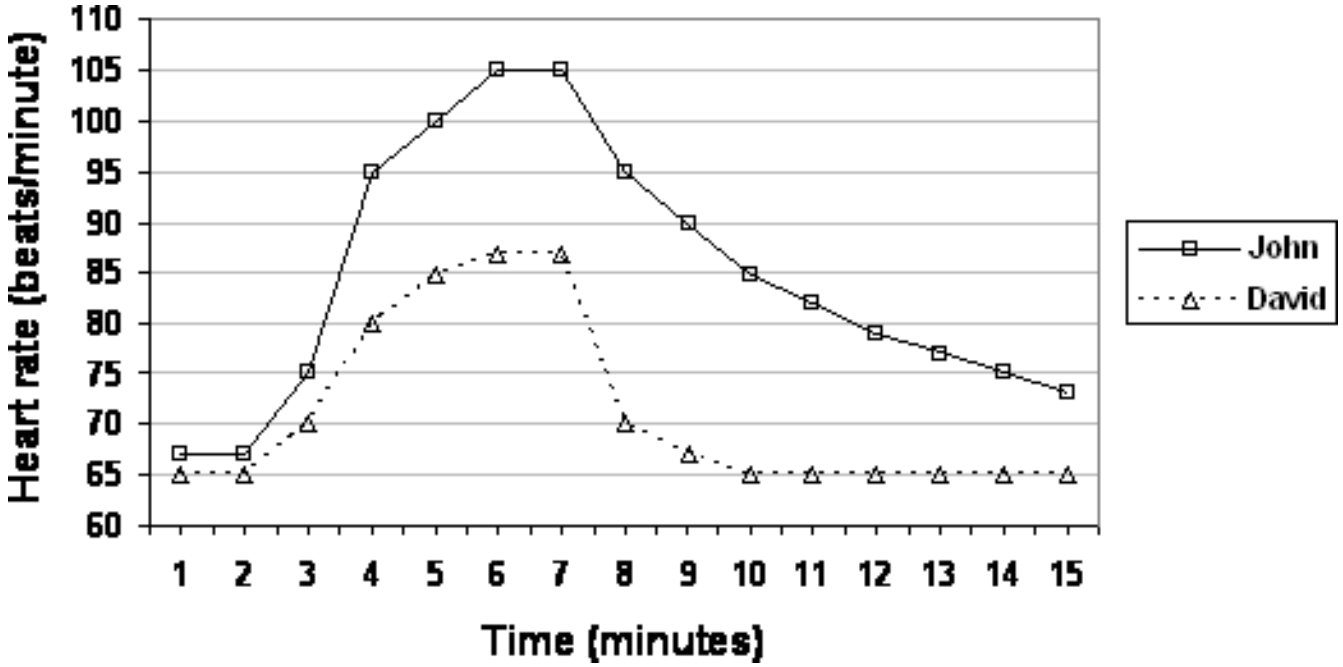
Heart Rate Recovery

Training will result in heart rate recovering quicker after exercise.



Describe what you see from these graphs.

Which athlete is trained and which is one is untrained? (Justify your answer!)

Effects of exercise on body systems

The long-term effects of exercise, or adaptations, on the respiratory system.

There is an increase in capillary density (capillarisation), which increases the efficiency of oxygen uptake for energy.

There is a slight increase in vital capacity, which means more air can be inspired, and also a slight increase in tidal volume, which means again more oxygen can enter the lungs.

There will also be an increase in Minute Volume, the amount of air inspired or expired in one minute.

There is greater intercostal muscle strength, allowing more air to be breathed in and out, and a reduction in resting respiratory rate, which makes the body more efficient.

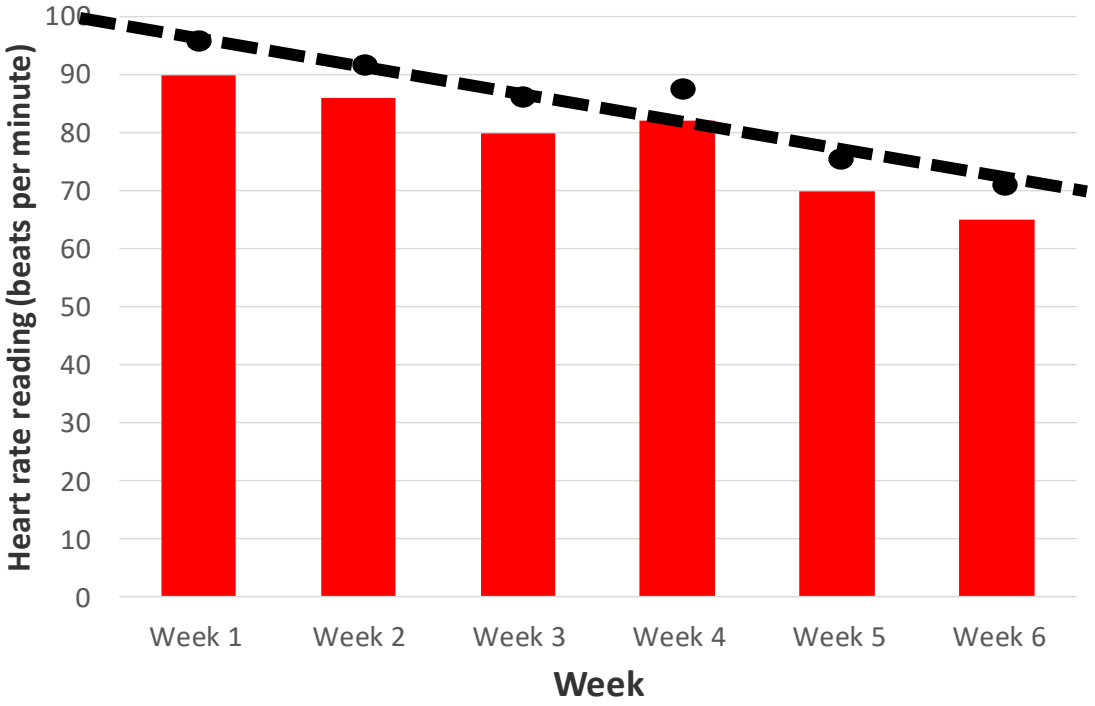
The exchange of gases at the alveoli (pulmonary diffusion) becomes more efficient and therefore the body can work harder and longer due to the increased surface area of the alveoli.

An increase in capillarisation again leads to more effective uptake of oxygen and more effective removal of carbon dioxide.

Effects of exercise on body systems

Interpreting data and graphs

The graph below shows Tom's resting heart rate recorded at each week of his training.



What do you notice?
What is the reason for this trend?

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Interpreting data and graphs

The tables below show Freddie's cardiovascular and respiratory measurement taken at rest and during exercise.

Heart rate (bpm)	Stroke volume (ml)	Breathing rate (number per min)	Muscle temperature
72	60	18	Normal

Freddie at REST

Heart rate (bpm)	Stroke volume (ml)	Breathing rate (number per min)	Muscle temperature
156	140	48	Hot

Freddie during exercise

Describe what the tables tell you?
Discuss why these changes have taken place?

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Apply it!