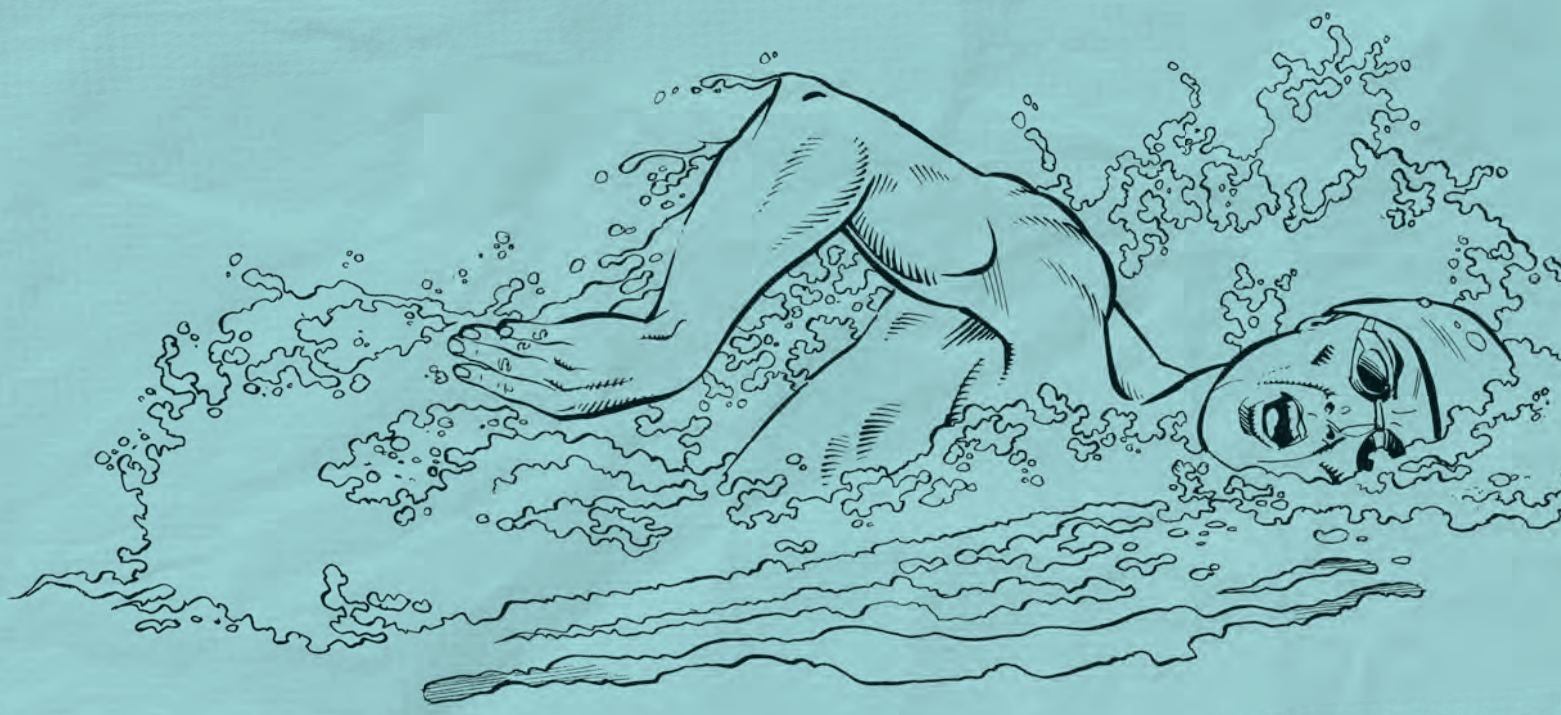
REVISE BTEC NATIONAL

Sport and Exercise Science

REVISION WORKBOOK



Pearson

REVISE BTEC NATIONAL
Sport and Exercise Science

REVISION WORKBOOK

Series Consultant: Harry Smith

Authors: Laura Fisher, Katie Jones, Tracy Richardson, Louise Sutton and Danielle Toward

A note from the publisher

While the publishers have made every attempt to ensure that advice on the qualification and its assessment is accurate, the official specification and associated assessment guidance materials are the only authoritative source of information and should always be referred to for definitive guidance.

This qualification is reviewed on a regular basis and may be updated in the future. Any such updates that affect the content of this Revision Workbook will be outlined at **www.pearsonfe.co.uk/BTECchanges**.

Pearson

Introduction

This Workbook has been designed to help you revise the skills you may need for the externally assessed units of your course. Remember that you won't necessarily be studying all the units included here – it will depend on the qualification you are taking.

BTEC Level 3 National Qualification	Externally assessed units
For both: Extended Certificate Foundation Diploma	2 Functional Anatomy 3 Applied Sport and Exercise Pyschology
Diploma	1 Sport and Exercise Physiology 2 Functional Anatomy 3 Applied Sport and Exercise Psychology
Extended Diploma	1 Sport and Exercise Physiology 2 Functional Anatomy 3 Applied Sport and Exercise Psychology 13 Nutrition for Sport and Exercise Performance

Your Workbook

Each unit in this Workbook contains either one or two sets of revision questions or revision tasks, to help you **revise the skills** you may need in your assessment. The selected content, outcomes, questions and answers used in each unit are provided to help you to revise content and ways of applying your skills. Ask your tutor or check the Pearson website for the most up-to-date **Sample Assessment Material** and **Mark Schemes** to get an indication of the structure of your actual assessment and what this requires of you. The detail of the actual assessment may change so always make sure you are up to date.

This Workbook will often include one or more useful features that explain or break down longer questions or tasks. Remember that these features won't appear in your actual assessment!

Grey boxes like this contain **hints and tips** about ways that you might complete a task, interpret a brief, understand a concept or structure your responses.

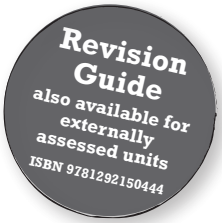
Guided

This icon will appear next to an **example partial answer** to a revision question or revision task. You should read the partial answer carefully, then complete it in your own words.

This is a **revision activity**. It will help you understand some of the skills needed to complete the revision task or question.

These boxes will tell you the pages where you can find more help in Pearson's BTEC National Revision Guide. Visit **www.pearsonschools.co.uk/revise** for more information.

There is often space on the pages of this Workbook for you to write in. However, if you are carrying out research and making ongoing notes, you may want to use separate paper. Similarly, some units may be assessed through submission of digital files, or on screen, rather than on paper. Ask your tutor or check the Pearson website for the most up-to-date details.



Contents

A small bit of small print

Pearson publishes Sample Assessment Material and the Specification on its website. This is the official content and this book should be used in conjunction with it. The questions in this book have been written to help you practise the knowledge and skills you will require for your assessment. Remember: the real assessment may not look like this.

Unit 1: Sport and Exercise Physiology

Your exam

Unit 1 will be assessed through an exam, which will be set by Pearson. You will need to use your understanding of exercise physiology in normal conditions and in different environmental conditions to answer a number of short- and long-answer questions.

Your Revision Workbook

This Workbook is designed to **revise skills** that might be needed in your exam. The selected content, outcomes, questions and answers are provided to help you revise content and ways of applying your skills. Ask your tutor or check the Pearson website for the most up-to-date Sample Assessment Material and Mark Scheme to get an indication of the structure of your actual exam and what this requires of you. The detail of the actual exam may change so always make sure you are up to date.

To support your revision, this Workbook contains revision questions to help you revise the skills that might be needed in your exam.

Question focus

Each question will relate to a content area in the specification:

- responses of the body systems to a single sport or exercise session
- fatigue and how the body recovers from exercise
- adaptations of the body systems to exercise
- environmental factors and sport and exercise performance.

Questions may start with a scenario that relates to an individual and gives different information about the person as you progress.

Types of questions

There is guidance in this Workbook for the skills involved in answering the following types of questions.

- Give
- Identify
- State/Name
- Describe
- Explain
- Analyse
- Assess
- Discuss
- Evaluate
- To what extent

Links To help you revise skills that might be needed in your Unit 1 exam, this Workbook contains two sets of revision questions starting on pages 2 and 21. The first is guided and models good techniques to help you develop your skills. The second gives you the opportunity to apply the skills you have developed. See the introduction on page iii for more information on features included to help you revise.

Revision paper 1

This Workbook is designed to revise skills that might be needed in your exam. The details of the actual exam may change so always make sure you are up to date. Ask your tutor or check the Pearson website for the most up-to-date Sample Assessment Material to get an idea of the structure of your exam and what this requires of you.

Answer ALL questions. Write your answers in the spaces provided.

1 a) Joe is an experienced member of his local gym club and participates in a range of fitness classes. His favourite exercise class is spinning which he does three times a week. Table 1 shows Joe's weekly training programme:

Day of the week	Time	Activity
Monday	07:30–08:15	Advanced spinning class
Tuesday	17:00–18:00	Weight training – upper body
Wednesday	07:30–08:15 18:00–19:00	Advanced spinning class Body Combat
Thursday		Rest day
Friday	17:00–18:00	Weight training – lower body
Saturday	08:30–09:15 18:00–19:00	Advanced spinning class Body Combat
Sunday	12:00–13:30	Abs/core workout and 10 km continuous running

Table 1

Explain how Joe's muscular system would respond to this training programme. 3 marks

When responding to **explain** questions, show your **understanding** by making a point or statement and linking it with a justification that expands the point.

Guided

Joe's training programme will recruit muscle fibres as the muscles are put under physical stress, helping the muscles to grow and adapt in size.

The process of vasoconstriction and vasodilation will increase .....

.....

.....

When under stress, Joe's muscles will contract and relax against each other causing .....

.....

.....

.....

Links See pages 3, 4 and 15 of the Revision Guide to revise muscular system responses to training.

1 b) Joe wears a heart rate monitor when he is training. He has noticed that his heart rate increases by an average of 9 beats per minute before he starts training.

Explain why Joe's heart rate increases just before he starts each exercise session. 3 marks

Your answer to this **explain** question should show your understanding of why Joe's heart rate increases and go on to link it with a justification that expands the point.

Guided

An initial increase is seen in Joe's heart rate, called an anticipatory rise, because ……,

……

……

This results in an increase in blood flow which ……

……

……

This process is a sub-conscious action which is used to ……

……

Links See pages 9 and 16 of the Revision Guide to revise factors affecting heart rate.

1 c) Joe often experiences symptoms of fatigue after completing a week's training programme.

Explain **two** ways Joe's musculoskeletal system can reduce the effect of fatigue after completing his exercise programme. 4 marks

To answer this question, state **two ways**, and **explain** and **expand** how each reduces the effect of fatigue. Ensure you choose two ways that you can properly explain.

Guided

1 Through training, Joe's ligaments and tendons have been subjected to an array of physical stresses which cause slight damage. The body produces collagen to heal the damage caused by the stress exercise places on them. This helps to strengthen the ligaments and tendons making them more resistant to fatigue.

2 ……

……

……

……

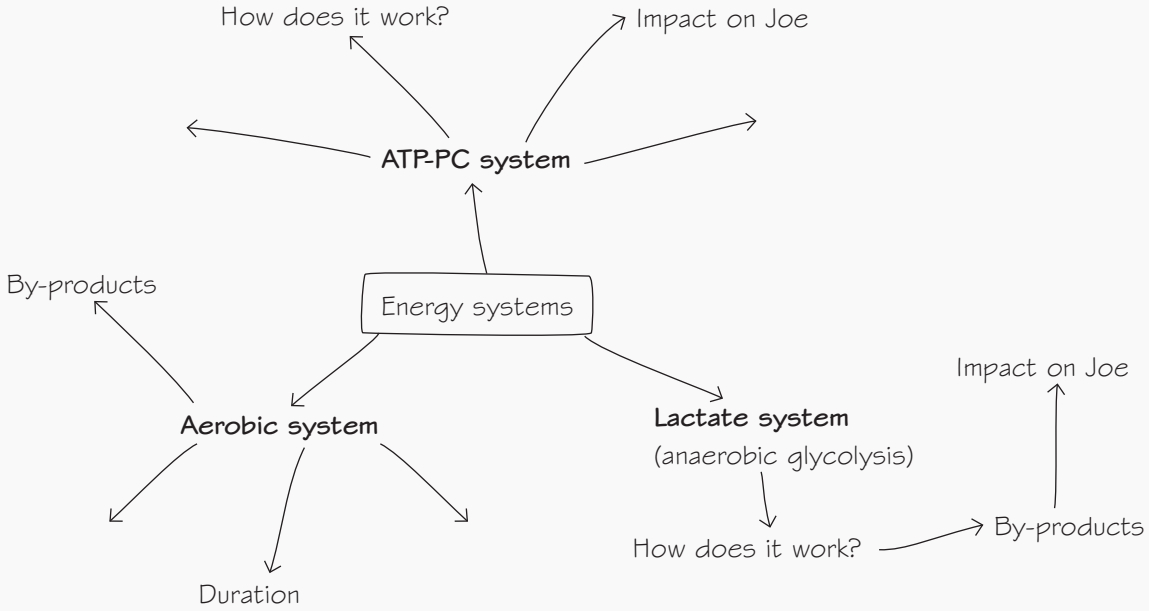
Links See page 26 of the Revision Guide to revise the effects of fatigue on the musculoskeletal system.

1 d) Joe's training programme uses both anaerobic and aerobic energy production.

Evaluate the effectiveness of the energy system continuum that Joe will use throughout his training regime in providing him with a constant supply of energy. 10 marks

In **evaluate** questions, you need to **review** information before bringing it together to form a **conclusion**. You need to give your judgement and support it. You should consider **strengths and weaknesses**, **alternative actions** and **relevant data** or **information**, e.g. of a theory, process or system.

You can produce a quick **thought plan** to help tackle questions that need longer answers. You could complete the plan below to get you started. You should refer to both aerobic and anaerobic energy systems, the duration of each system, the relationships between each energy system and the by-products that are produced by each system.



Guided

Joe's fitness training programme will use all three energy systems which support the aerobic and anaerobic demands of each exercise. For Joe to be successful he needs to rely on the ATP–PC system, lactate system and aerobic energy system.

ATP–PC is the first energy system which provides enough power for a few seconds of all-out exercise. The energy system relies on .....

.....

.....

The ATP–PC system helps Joe with his training programme because it produces .....

.....

The by-products produced by this system are .....

.....

These molecules .....

.....

There is a small amount of creatine phosphate in our body. This limits the .....

.....

The second energy system that Joe will use is the lactate system. This is also known as anaerobic glycolysis. This energy system .....

.....

.....

This energy system is important because .....

.....

The by-products produced by this system are .....

These by-products will affect Joe's performance because .....

.....

.....

.....

The final energy system to be evaluated is the aerobic system. This system lasts for hours as it relies on a constant supply of oxygen.

Carbon dioxide and water are by-products for this energy system which uses

.....

The aerobic energy system works by .....

.....

.....

.....

This energy system will affect Joe's performance by .....

.....

To summarise, energy systems are viewed as a continuum as .....

.....

.....

.....

.....

See pages 18–22 of the Revision Guide to revise the energy system continuum.

Total for Question 1 = 20 marks

2 a) Gabriella is a triathlete who is competing in the 24-hour Ironman World Championship in Hawaii. The event involves three stages.
Stage one: 2.4 mile swim in open water
Stage two: 112 mile bike ride across mountain terrain with high winds
Stage three: 26.2 mile run through the capital city

Describe what will happen to Gabriella's a-VO_2 diff between stage one and stage two. 3 marks

When responding to **describe** questions, give an account, or details, of 'something' or give an account of a 'process'.
In this question, think about the difference in the amount of oxygen found between arterial and venous blood. Describe why the oxygen levels would have differences in intensities between stage 1 and stage 2.

Guided

Arteriovenous oxygen difference (a-VO_2 diff) is the difference in the amount of oxygen found

.....

The difference between stage 1 and stage 2 will .....

.....

.....

.....

The difference between arterial and venous blood increases due to the .....

.....

.....

Links To revise arteriovenous oxygen difference (a-VO_2 diff), see page 13 of the Revision Guide.

2 b) As Gabriella's Ironman event will take place over a 24-hour period, it is essential that she has a sufficient supply of nutrients in her body to support sustained energy production.

Explain what nutritional substances can be consumed by Gabriella during the Ironman event which will support her in completing the challenge. 4 marks

You need to show your **understanding** of what constitutes a nutritional substance, i.e. what makes up a balanced diet. Think about the **demands of the event** and the **methods** by which Gabriella can take on board nutrients, for example shakes and gels. Consider what the **nutritional substances do**, for example carbohydrates and proteins. **Explain** how these will support Gabriella to complete the Ironman challenge.

Guided

Due to the duration of Gabriella's event taking place over a 24-hour period, there will be limited opportunities to .....

Therefore, Gabriella will need .....

Protein is needed to .....

.....

Gabriella will also need a supply of .....

.....

Links See page 25 of the Revision Guide to revise information on nutritional substances and their role in supporting aerobic performance.

2 c) Part way through stage 3 of the Ironman event, Gabriella begins to experience a significant reduction in her race pace. Her muscles are aching and she is struggling to make repeated muscle contractions.

Explain the effects that neuromuscular fatigue would have on Gabriella's race performance.

3 marks

You need to **explain** what neuromuscular fatigue is, what units are involved and how a reduction in these units **impacts** on Gabriella's performance.

Guided

Neuromuscular fatigue is common after exposure to .....

The motor units from the central nervous system .....

.....

The loss of .....

.....

Acetylcholine is released by the .....

.....

However, when this gets depleted the muscle fibres are unable to .....

.....

Links See page 23 of the Revision Guide to revise what neuromuscular fatigue is and the effect it has on performance.

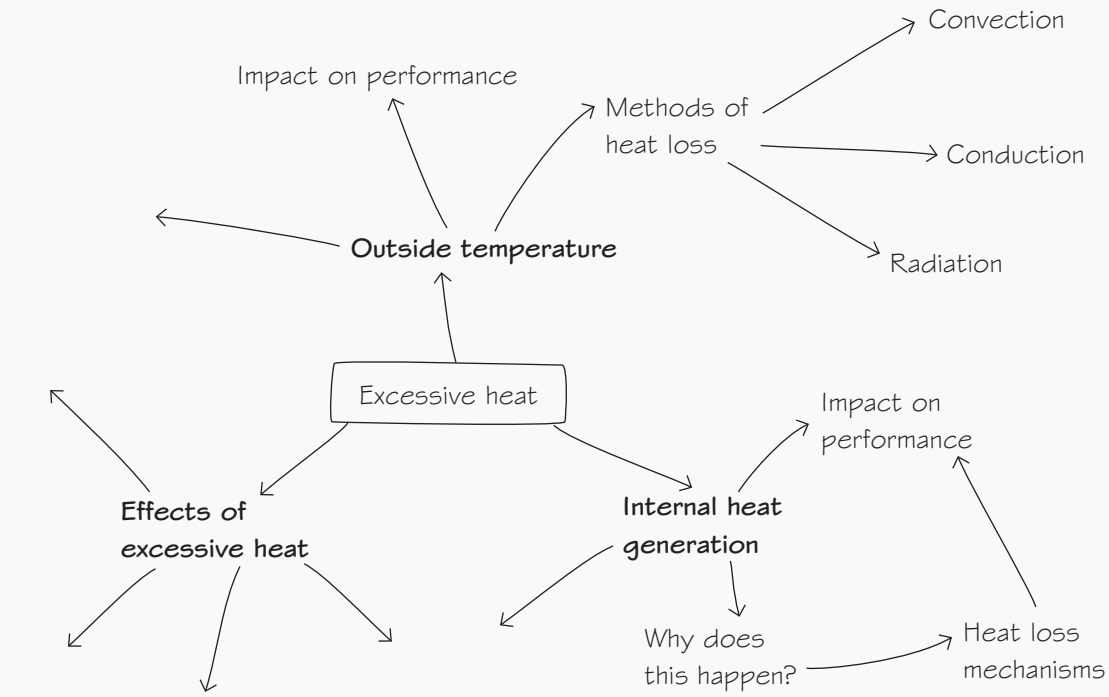
2 d) The race organisers have issued a formal warning informing athletes that temperatures are expected to peak at 39°C, accompanied by humid conditions.

Analyse the effect that exposure to excessive heat will have on Gabriella's body and performance.

10 marks

When responding to **analyse** questions, carry out a detailed examination in order to discover the **meaning** or **essential features** of a theme, topic or situation. You will need to **break something down** into its component parts and examine **factors** methodically and in detail. In addition, you will have to identify separate factors, say how they are related and explain how each one contributes to the topic.

You can produce a quick **thought plan** to help tackle questions that need longer answers. You could complete the plan below to get you started.



Guided

The predicted outside temperature for Gabriella's competition is high. As Gabriella exercises, she will also be generating heat as a waste product of exercise. To help combat the excess heat, Gabriella's body will work hard to cool .....

.....

Heat will be lost through .....

.....

.....

.....

.....

.....

.....

When Gabriella sweats she will lose electrolytes and water during the cooling process. The more Gabriella sweats the greater the depletion of electrolytes. It is important that .....

.....

.....

.....

.....

.....

.....

The temperature that is predicted for Gabriella's race is considered to be an extreme temperature. Exposure to extreme heat temperatures will produce .....

.....

.....

.....

.....

Based on the predicted temperatures, it is clear that Gabriella will suffer from .....

.....

.....

.....

.....

Dehydration can cause .....

.....

See pages 45–50 of the Revision Guide to revise what excessive heat is, how the body adapts to it and the impact of excessive heat on performance.

Total for Question 2 = 20 marks

3 a) Parvez is a busy full-time student who is juggling college work and a part-time job. Parvez carries out high-intensity interval training (HIIT) to help him improve his cardiovascular fitness. He has developed an eight-week training programme which targets all the major muscle groups including his core.

For Parvez's first five-week period, he completed three training sessions a week working on all major muscle groups.

For the final three weeks, Parvez completed HIIT training every other day allowing the second day to become a rest day.

Parvez completed a range of tests prior to completing this training programme so that he could see how much he improves. Table 2 shows the range of tests used and the results at key stages.

	Week 1	**Week 4**	**Week 8**
Weight	99.3 kg	89.5 kg	91.6 kg
Body fat	31.2%	28.4%	24.2%
VO_2 max	33 ml/kg/min	36 ml/kg/min	39 ml/kg/min
1RM bench press	45 kg	50 kg	54 kg
1 RM back squat	75 kg	87 kg	91 kg

Table 2

Give **three** examples of the different muscle fibres recruited by Parvez to perform his HIIT training exercises.

3 marks

When answering **give** questions, provide **examples**, **justifications**, and/or **reasons** for something.

Think about the **three types of muscle fibres** and **apply** these to the examples that Parvez uses in his HIIT training.

Guided

1 Type I muscle fibres will be used when Parvez is working at a low intensity for a long duration, e.g. jogging.

2 Type IIa muscle fibres will be used to provide .....

.....

.....

3 Type IIx muscle fibres will be used to provide .....

.....

.....

Links See pages 3–4 of the Revision Guide to revise muscle fibre recruitment and exercise effects.

3 b) During HIIT exercises, the nervous system plays a crucial role in ensuring that the body continues to respond to motor neurons sent from the central nervous system. The respiratory system responds by ensuring that Parvez has enough oxygen in his blood to supply the working muscles, assisting them to make repeated explosive contractions without fatigue.

Explain why the onset of blood lactate (OBLA) occurs during Parvez's HIIT training sessions.

4 marks

You could **break** the answer into **two parts**. First, explain what OBLA is and when it occurs. Then for the second part you need to relate your answer to Parvez's training sessions. Think about the intensity of the exercise and the energy system that HIIT training predominantly uses.

Guided

The onset of blood lactate (OBLA) occurs when the level of lactate in the blood reaches 4 mmol/L and above. 4 mmol/L is known as the .....

OBLA happens when .....

.....

.....

.....

When exercise continues when blood lactate is above 4 mmol/L .....

.....

.....

With HIIT training, Parvez will experience OBLA .....

.....

.....

The rest period between the work periods .....

.....

Links See pages 20 and 22 of the Revision Guide to revise the onset of blood lactate.

3 c) After eight weeks of HIIT training, Parvez reviewed the effectiveness of his training programme. He found that, after reducing his number of rest days, the gains in training decreased as compared to his improvement between weeks 1 and 4.

Parvez also found it a struggle getting up and down the stairs when he increased his training.

He decided to complete a further four-week training programme but reduce the training frequency to three times a week, using the same measures as before. The results are shown in Table 3.

	Week 8	**Week 12**
Weight	91.6 kg	83.3 kg
Body fat	24.2%	21.8%
VO_2 max	39 ml/kg/min	56 ml/kg/min
1RM bench press	54 kg	75 kg
1 RM back squat	91 kg	109 kg

Table 3

Fatigue has had an impact on Parvez's ability to be able to significantly improve his cardiovascular fitness in week 8.

Explain, using Table 3, how fatigue has affected Parvez's week 8 results. 3 marks

You need to use the **results in Table 3** and **compare the differences** between **week 8 and week 12**. You can also look at the results from **Table 2** (page 11) for **week 4** as a comparison. For this type of question, you need to be able to explain the **effectiveness** of a change and whether it has had a **positive**, **negative** or **neutral impact**. It is essential that you use information from the **table** to construct your answer.

Guided

Energy sources can become depleted in the training sessions and within the recovery period.

……..

……..

Parvez will experience delayed onset of muscle soreness (DOMS). This is a discomfort ……..

……..

……..

The pain and stiffness experienced as a result of DOMS ……..

……..

……..

……..

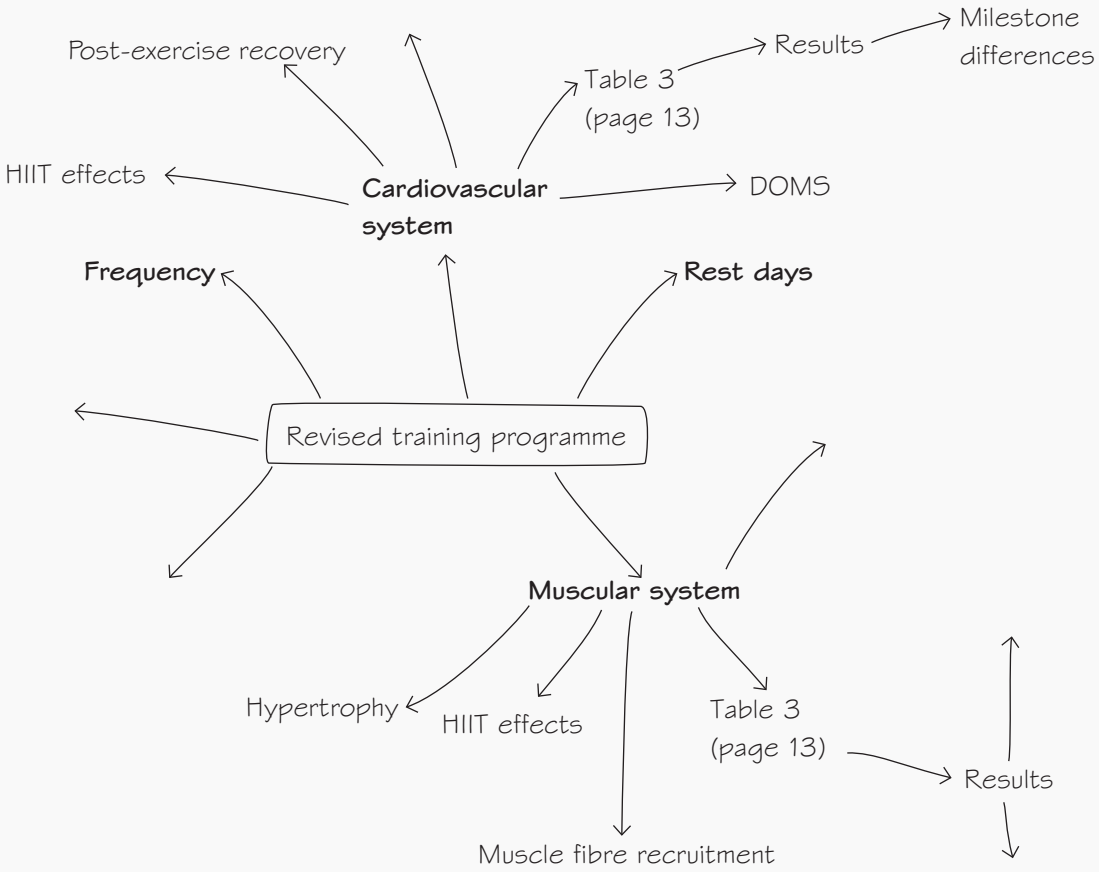
Links See pages 23–26 of the Revision Guide to revise the effect of fatigue on exercise performance.

3 d) To what extent has the revised training programme affected Parvez's cardiovascular and muscular systems?

10 marks

When answering **to what extent** questions, **review information then bring it together** and form a **conclusion** or a **judgement**. It is important that your answer includes a **balanced** and **reasoned** argument.

You can produce a quick **thought plan** to help tackle questions that need longer answers. You could complete the plan below to get you started.



Guided

Over the 12-week training period, Parvez has improved his VO_2 max result at each stage.

However, between weeks 4 and 8 the change in test results was small.

An increase in Parvez's VO_2 max shows .....

.....

.....

The higher the VO_2 max, ...

A greater VO_2 max allows Parvez to continue .....

.....

An increase in Parvez's VO_2 max also assists him to .....

.....

Parvez will be able to withstand a higher amount of .....

.....

The change in frequency of the training programme, back to three times a week, has enabled Parvez to be able to continue to make progress in improving his cardiovascular fitness. The change in frequency has also .....

.....

.....

EPOC becomes more effective at minimising the effect of .....

.....

Parvez's results in week 12 have improved since the training sessions were reduced to three per week as opposed to every other day between weeks 5 and 8. By reducing the frequency .....

.....

.....

Providing Parvez has a sufficient amount of rest in between training sessions .....

.....

.....

As a result of hypertrophy, Parvez's muscles will be able to generate .....

.....

.....

Over time, Parvez's muscles will adapt to HIIT. HIIT uses heavy loads, i.e. body weight exercises. This causes Type IIa muscle fibres to .....

.....

.....

.....

.....

Links See pages 3, 4 and 9–15 of the Revision Guide to revise the effects of exercise on the body systems and pages 30–37 to revise how adaptations impact exercise performance.

Total for Question 3 = 20 marks

4 a) Naseem is a county level swimmer. Her favourite race to compete in is 200 m butterfly. She is currently training for national trials and is working hard to reduce her 200 m time. She trains for 2 hours a day, five days a week. Her training sessions consist of both land and pool training. These training sessions consist mainly of aerobic activities.

Identify **three** ways in which Naseem's cardiovascular system responds to aerobic training. 3 marks

When answering **identify** questions, you may need to assess **factual information** that may require a single word answer, although sometimes a few words or a maximum of a single sentence are required. Be careful not to spend too much time on a long and detailed answer as this is **not** needed.

Guided

1 Vasoconstriction – occurs in blood vessels that do not need an enhanced blood supply during exercise, while vasodilation occurs in active muscles by .....

.....

.....

2 Increased cardiac output – occurs as the volume of blood pumped out per minute .....

.....

.....

.....

.....

3 .....

.....

Links See pages 9–13 of the Revision Guide to revise cardiovascular responses to exercise.

4 b) Explain **two** ways Naseem's aerobic energy system adapts to both land and pool training sessions. 4 marks

This question is specific to **aerobic energy systems** so it is important that your answer **focuses** on this and not any other energy system. You need to select two adaptations that occur during exercise training sessions. Think about the demands of the sport – what will help Naseem's performance to improve?

Guided

1 During the first few minutes of Naseem's training session, in the pool or on land, her body will be fuelled by anaerobic metabolism due to .....

.....

.....

.....

2 Naseem's training programme, in the pool or on land, will be fuelled by carbohydrate and fat stores which .....

.....

.....

.....

.....

.....

Links See pages 21 and 37 of the Revision Guide to revise the aerobic energy system and adaptations.

4 c) Naseem has 48 hours until she competes in her national trial. It is important that she is both physically and mentally prepared for the event. As part of her training cycle, she is also given nutritional guidelines as to what food groups she should eat and when, in order to optimise her performance.

Explain why it is important that Naseem consumes a high carbohydrate diet over the next 48 hours. 3 marks

When answering this question, **explain three points** to say **why it is important** that Naseem consumes a **high carbohydrate** diet on the lead up to competition.

Guided

Naseem will use her glycogen stores in the muscles to break down the glycogen enzymes into glucose which .....

.....

.....

An increased level of carbohydrates in Naseem's muscles will provide Naseem with .....

.....

.....

By having more carbohydrates in the body, she will be able to .....

.....

Links See page 21 of the Revision Guide to revise aerobic metabolism.

4 d) Following completion of her three-month training cycle, Naseem performs a series of tests to measure the effectiveness of it. Naseem and her coach use this information from the tests to review how effective the training programme has been. Table 4 shows the results of her cardiovascular and respiratory functioning at the start and at the end of her training cycle.

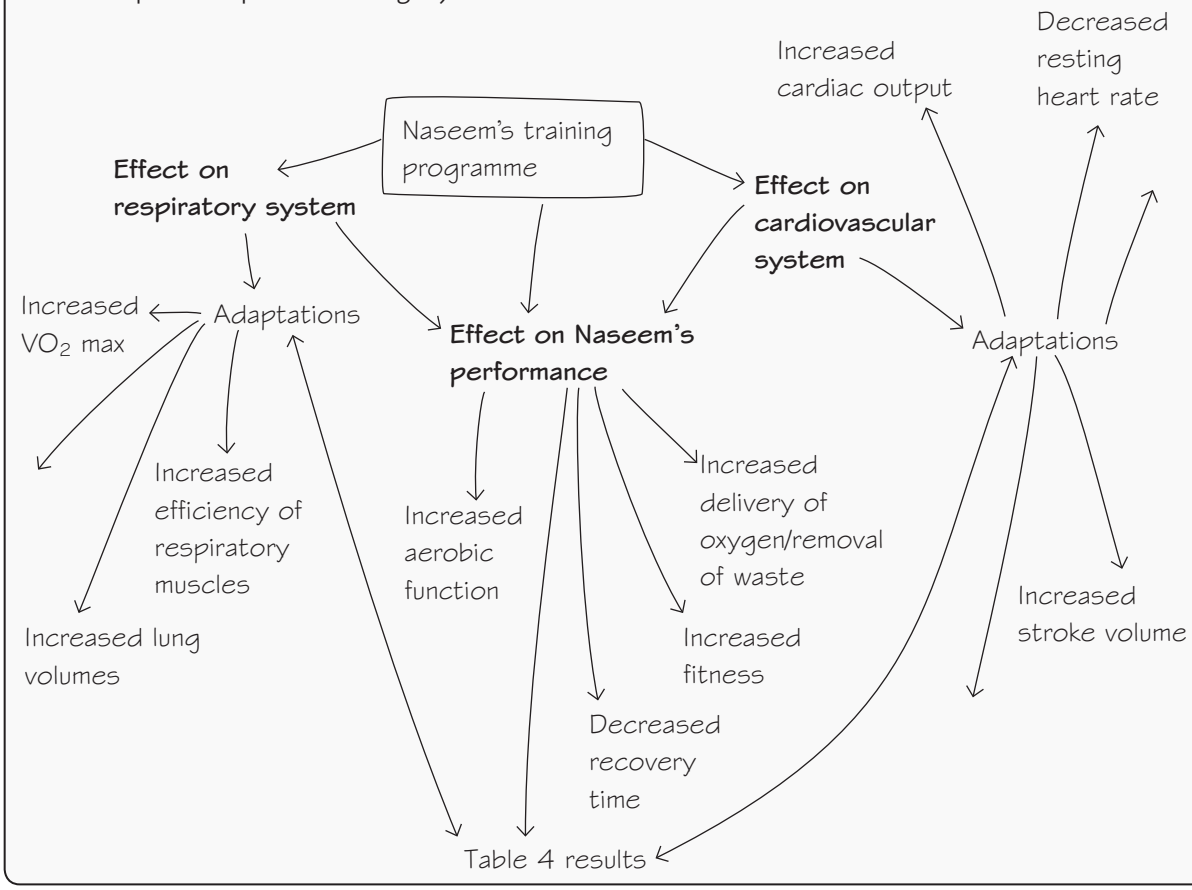
Measure	Start of training cycle	End of training cycle
Forced vital capacity	4.0 L	4.7 L
VO_2 max	46 ml/kg/min	51 ml/kg/min
Body fat	22.1%	16.9%
Resting heart rate	56	54

Table 4

Discuss the effect that Naseem's training programme has had on her cardiovascular and respiratory systems and how this will affect Naseem's fitness for her national swimming trials. 10 marks

When answering **discuss** questions, **identify** the issue, situation, problem or argument that is being assessed in the question given. You need to **explore** all aspects and **investigate** it fully. Come to a **conclusion** that sums up the **outcome** of the discussion, at the end.

You can produce a quick **thought plan** to help tackle questions that need longer answers. You could complete the plan below to get you started.



Guided

Naseem's training programme has been effective at putting the cardiovascular and respiratory systems under increased pressure causing them to .....

.....

This is supported by the results in Table 4 in which all results have shown .....

.....

Through sustained aerobic training Naseem will have increased her stroke volume which slows down her .....

.....

This adaptation can be evidenced in the decrease in Naseem's .....

.....

Naseem's maximal cardiac output will assist in supplying the working muscles with .....

.....

.....

Table 4 shows that there has been a significant improvement in her lung function volumes. This will assist Naseem to breathe in more .....

.....

The cardiovascular system becomes more efficient as the respiratory muscles increase in .....

.....

The higher the contraction rate the greater the volume of air. This effect is evidenced by the 700 ml increase in the .....

Naseem's tidal volume, vital capacity and residual volume increase with sustained aerobic training. Naseem will be able to utilise the increased amount of oxygen present in the system and .....

.....

The delay in the onset of blood lactate is a result of Naseem's increased VO_2 max because Naseem is able to utilise .....

.....

Naseem's body will adapt and her respiratory rate will increase to aid the .....

.....

.....

.....

.....

Links See pages 30–37 of the Revision Guide to revise the effects of aerobic training on the cardiovascular and muscular system and the impact of the adaptations on sporting performance.

Total for Question 4 = 20 marks

END OF PAPER

TOTAL FOR PAPER 1 = 80 MARKS