



*Rewarding Learning*

**General Certificate of Secondary Education  
2016**

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## **Physical Education**

**Paper 1**

**[G9741]**

**FRIDAY 20 MAY, AFTERNOON**

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# **MARK SCHEME**

## General Marking Instructions

### Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

### The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

		AVAILABLE MARKS
1	The other two areas are: <b>physical</b> health and <b>mental</b> health. Award [0] for an answer not worthy of credit. Award [1] for each of physical health and mental health. (2 × [1])	2
2	The word is <b>skill</b> . Award [0] for an answer not worthy of credit. Award [1] for <b>skill</b> being the term.	1
3	Example answer. If a person played field hockey, there is the risk of being hit with the ball or a stick on the mouth and damaging the teeth. Players should therefore reduce the risk by wearing a mouth guard. Award [0] for an answer not worthy of credit. Award [1] for an acceptable health and safety risk associated with playing a sport. Award [2] for an acceptable health and safety risk associated with playing a sport <b>and</b> an explanation of an appropriate step that can be taken to reduce the risk. [2]	2
4	Example answers. <ul style="list-style-type: none"> <li>• A school with an ethos for participation in physical activity and/or sport immerses its pupils in this culture and the pupils are therefore more likely to become involved in physical activity or sport.</li> <li>• PE within schools can provide opportunities to try different physical activities and sports, so pupils discover the physical activities and sports that they enjoy or are good at, so participate.</li> <li>• Schools offer extra-curricular activities, so pupils can experience other physical activities not offered in the curriculum. These activities can interest them and so they participate.</li> <li>• Role models in the school (teachers and other pupils) can encourage pupils to get involved or to continue to participate in physical activities or sports.</li> <li>• The fact that past pupils have been successful at physical activities or sports can encourage present pupils to participate in physical activities or sports.</li> <li>• The interest or enthusiasm of a teacher or coach in a sport can encourage pupils to participate.</li> <li>• The interest or enthusiasm of other pupils in physical activities or sports can encourage peers to participate.</li> </ul> Award [0] for an answer not worthy of credit. Award [1] for each valid example given on how pupils' experiences at school can positively affect their participation in physical activity or sport. (3 × [1])	3
5	Example answers. <ul style="list-style-type: none"> <li>• If a person's occupation/job allows the person to have a lot of leisure time (e.g. part-time work) then the person can train and compete in competitive team sport without difficulty.</li> <li>• If a person's occupation/job does not allow the person to have a lot of leisure time (e.g. overseas sales person) then the person may not be able to train and compete in competitive team sport regularly without difficulty.</li> <li>• If a person works the same regular hours each day (e.g. 9 am–5 pm) and is off work at weekends then the person can usually train and compete in their competitive team sport without difficulty.</li> <li>• If a person works flexible hours then they can usually train and compete in their competitive team sport without difficulty as they can arrange their work hours around training and competing.</li> </ul>	

- If a person works shifts, their hours can be irregular or antisocial. The person can find it difficult to train and compete competitively as they could be working at these times. Also shift work can upset normal routines and affect performance.
- If a person is unemployed, they may have lots of time available for training and competing in competitive team sports, however, financial restraints may limit their opportunities.

Award [0] for an answer not worthy of credit.

Award [1] for each valid example given on how a person's occupation/job may affect participation in competitive team sports.

(3 × [1])

[3]

AVAILABLE  
MARKS

3

- 6 (a)** Fig. 1 shows that there is a greater energy intake than energy output. The outcome of this will be that the person will put on weight.  
Award [0] for an answer not worthy of credit.  
Award [1] for the correct explanation of what Fig. 1 shows **or** for the correct explanation of the outcome.  
Award [2] for the correct explanation of what Fig. 1 shows **and** for the correct explanation of the outcome. [2]

- (b)** Fig. 2 shows that there is a greater energy output than energy input. The outcome of this will be that the person will lose weight.  
Award [0] for an answer not worthy of credit.  
Award [1] for the correct explanation of what Fig. 2 shows **or** for the correct explanation of the outcome.  
Award [2] for the correct explanation of what Fig. 2 shows **and** for the correct explanation of the outcome. [2]

4

- 7 (a)** Anaerobic fitness is about being able to perform at very high intensities or at maximum or near maximum effort or without oxygen.  
Award [0] for an answer not worthy of credit.  
Award [1] for clear explanation of what anaerobic fitness is.  
E.g. Anaerobic fitness is about being able to perform at maximum effort. [1]

- (b)** Anaerobic energy production is determined by the ability of the muscles and liver to store fuel and the ability of the muscles to utilize this fuel.  
Award [0] for an answer not worthy of credit.  
Award [1] for a limited explanation of what determines a person's anaerobic energy production.  
E.g. Anaerobic energy production is determined by the ability of the muscles to store fuel.  
Award [2] for a satisfactory explanation of what determines a person's anaerobic energy production.  
E.g. Anaerobic energy production is determined by the ability of the muscles and liver to store fuel.  
Award [3] for clear and detailed explanation of what determines a person's anaerobic energy production.  
E.g. Anaerobic energy production is determined by the ability of the muscles and liver to store fuel and the ability of the muscles to utilize this fuel. [3]

4

- 8 (a)** Muscular endurance is determined by the ability of the muscles or group of muscles to work for long periods of time at less than maximum effort.  
Award [0] for an answer not worthy of credit.  
Award [1] for a satisfactory explanation of what determines a person's muscular endurance.  
E.g. Muscular endurance is determined by the ability of the muscles to work for long periods of time.  
Award [2] for a clear and detailed explanation of what determines a person's muscular endurance.  
E.g. Muscular endurance is determined by the ability of the muscles or group of muscles to work for long periods of time at less than maximum effort (with oxygen). [2]
- (b)** Flexibility is determined by the ability of the muscles and ligaments surrounding joints to stretch to allow the full range of movement at the joints.  
Award [0] for an answer not worthy of credit.  
Award [1] for a satisfactory explanation of what determines a person's flexibility.  
E.g. Flexibility is determined by the ability of the muscles surrounding joints to stretch.  
Award [2] for a clear and detailed explanation of what determines a person's flexibility.  
E.g. Flexibility is determined by the ability of the muscles and ligaments surrounding joints to stretch to allow the full range of movement at the joints. [2]
- 9 (a)** An aerobic workout using continuous steady pace training would involve continuous work at a steady pace. Once the heart rate reaches an appropriate intensity (e.g. 75% of maximum heart rate) it is maintained at that intensity for a long period of time (e.g. at least 20 minutes).  
Award [0] for an answer not worthy of credit.  
Award [1] for a partial explanation of what is involved in doing an aerobic workout, using continuous steady pace training.  
E.g. It involves working continuously at a desired intensity/work rate OR it involves working continuously for a set period of time (e.g. 30 minutes).  
Award [2] for a clear and detailed explanation of what is involved in doing an aerobic workout, using continuous steady pace training.  
E.g. It involves working continuously at an appropriate intensity/work rate (70% MHR) **and** for a set period of time (e.g. 30 minutes). [2]
- (b)** Example answers.  
Rowing; cycling; swimming; skating; cross-country skiing.  
Award [0] for an answer not worthy of credit.  
Award [1] for an appropriate type of exercise.  
(2 × [1]) [2]

AVAILABLE  
MARKS

4

4

		AVAILABLE MARKS
<p><b>10</b> An isotonic exercise involves a muscle or group of muscles working against a resistance and movement of body parts takes place, whereas with an isometric exercise the muscle or group of muscles is working against a resistance but no movement of body parts takes place. Award [0] for an answer not worthy of credit. Award [1] for a partial explanation of the difference between an isotonic and an isometric exercise. E.g. An isotonic exercise involves a muscle or group of muscles working against a resistance and movement of body parts takes place OR an isometric exercise involves a muscle or group of muscles working against a resistance but no movement of body parts takes place. Award [2] for a clear and detailed explanation of the difference between an isotonic and an isometric exercise. An isotonic exercise involves a muscle or group of muscles working against a resistance and movement of body parts takes place, whereas with an isometric exercise the muscle or group of muscles is working against a resistance but no movement of body parts takes place.</p>	[2]	2
<p><b>11</b> In the context of the 'FITT principle', intensity refers to how hard the person has to work. An appropriate intensity could be a heart rate (e.g. 140 bpm); a percentage of maximum heart rate (MHR) (e.g. 80% MHR); a given distance with a time in which the distance has to be completed (e.g. 10km in 60 minutes); a Repetition Maximum (RM) (e.g. 10RM); a weight (e.g. 50kg) etc. Award [0] for an answer not worthy of credit. Award [1] for a clear explanation of what intensity is in the context of the FITT principle OR for providing an appropriate example. E.g. In the context of the 'FITT principle', intensity refers to how hard the person has to work. OR A Repetition Maximum of 10RM would be an example of an intensity. Award [2] for a clear explanation of what intensity is in the context of the FITT principle AND for providing an appropriate example. E.g. In the context of the 'FITT principle', intensity refers to how hard the person has to work. It can, for example, be shown as a heart rate (140 bpm) or a percentage of maximum heart rate (75% MHR).</p>	[2]	2
<p><b>12</b> The <b>weight</b> can be increased for the exercise or the <b>number of repetitions</b> can be increased or the <b>number of sets</b> can be increased. Award [0] for an answer not worthy of credit. Award [1] for any one of the above answers. (2 × [1])</p>	[2]	2

- 13** The principle of variety can be applied to develop aerobic fitness by:
- including more than one type of aerobic activity in the exercise programme. For example, running on a Monday; swimming on a Tuesday; dancing on a Thursday;
  - using different types of training methods in the exercise programme. For example, continuous steady pace, fartlek and interval training;
  - using different venues, different days and different times of the day to provide variety in the exercise programme. For example, gym on Monday; park on Wednesday
- Award [0] for an answer not worthy of credit.  
Award [1] for a clear explanation or an appropriate example as to how the principle of variety can be applied to develop aerobic fitness in a health-related exercise programme.  
E.g. The principle of variety can be applied to develop aerobic fitness by including more than one type of aerobic activity in the exercise programme.  
Award [2] for a **clear explanation** with an **appropriate example** as to how the principle of variety can be applied to develop aerobic fitness in a health-related exercise programme.  
E.g. The principle of variety can be applied to develop aerobic fitness by including more than one type of aerobic activity in the exercise programme. For example, running on a Monday; swimming on a Tuesday; dancing on a Thursday. [2]
- 14** By stopping the fitness training the person will gradually lose their level of physical fitness. This is because the biological adaptations, produced by the body (e.g. more blood capillaries in the muscles; more red blood cells being created; muscular hypertrophy) will be reversed or lost.  
Award [0] for an answer not worthy of credit.  
Award [1] for a satisfactory explanation as to how the principle of reversibility affects a person who has become physically fit by doing fitness training and who then stops doing the fitness training.  
E.g. By stopping the fitness training the person will gradually lose their level of physical fitness.  
Award [2] for a clear in-depth explanation as to how the principle of reversibility affects a person who has become physically fit by doing fitness training and who then stops doing the fitness training.  
E.g. By stopping the fitness training the person will gradually lose their level of physical fitness. This is because the biological adaptations, produced by the body (e.g. more blood capillaries in the muscles; more red blood cells being created; muscle hypertrophy) will be reversed or lost. [2]
- 15** The immediate response of the respiratory system to strenuous exercise is for the ventilation to increase. That is the amount of air breathed in and out during a minute. This is achieved by increasing the frequency of breaths per minute and by increasing the volume of air taken in in each breath.  
Award [0] for an answer not worthy of credit.  
Award [1] for a moderate understanding of the immediate response of the respiratory system to strenuous exercise.  
E.g. The immediate response of the respiratory system to strenuous exercise is to increase the frequency of breaths per minute (breathe faster).  
Award [2] for a clear and competent understanding of the immediate response of the respiratory system to strenuous exercise.  
E.g. The immediate response of the respiratory system to strenuous exercise is to increase the frequency of breaths per minute **and** to increase the volume of air taken in in each breath (breathe faster and deeper). [2]

AVAILABLE  
MARKS

2

2

2

- 16** The immediate response of the heart to strenuous exercise is for the cardiac output to increase. This is achieved by increasing the heart rate per minute and by increasing the stroke volume.  
Award [0] for an answer not worthy of credit.  
Award [1] for a moderate understanding of the immediate response of the heart to strenuous exercise.  
E.g. The immediate response of the heart to strenuous exercise is for the heart rate per minute to increase.  
Award [2] for a clear and competent understanding of the immediate response of the heart to strenuous exercise.  
E.g. The immediate response of the heart to strenuous exercise is for the heart rate per minute to increase **and** for the stroke volume to increase (the amount of blood pumped from the heart per beat increases). [2]

AVAILABLE  
MARKS

2

- 17** The immediate response of the digestive system to strenuous exercise is to stop the process of digesting food. The precapillary sphincters limit the percentage of blood going to the stomach, intestines and kidneys. Blood flow is largely diverted to the muscles.  
Award [0] for an answer not worthy of credit.  
Award [1] for a moderate understanding of the immediate response of the digestive system to strenuous exercise.  
E.g. The immediate response of the digestive system to strenuous exercise is to stop the process of digesting food.  
Award [2] for a clear and competent understanding of the immediate response of the digestive system to strenuous exercise.  
E.g. The immediate response of the digestive system to strenuous exercise is to stop the process of digesting food. The precapillary sphincters limit the percentage of blood going to the stomach, intestines and kidneys. OR Blood flow is largely diverted to the muscles. [2]

2

- 18** Example answers.  
Explanations of arguments for endurance athletes not smoking tobacco:
- Smoking tobacco constricts the lungs' air passages. This means it is more difficult to breathe air into the lungs. For a set work rate a person would have to breathe faster and deeper than before to get the required amount of oxygen.
  - The tar, dust and soot from the tobacco smoke lies in the alveoli (air sacs) in the lungs. This means there is less surface area than before for the exchange of oxygen and carbon dioxide. For a set work rate you would have to breathe faster and deeper than before to get the required amount of oxygen, again resulting in less efficient aerobic performance.
  - Blood vessels are constricted as a result of smoking tobacco. This means the heart has to work harder and blood pressure will be raised. For a set work rate the heart would have to beat faster than before to get the required amount of oxygen to the muscles, and aerobic performance would therefore be less efficient.
  - Carbon monoxide from the tobacco smoke takes the place of oxygen in the red blood cells. This means there is less oxygen available than before. For a set work rate the heart would have to beat faster than before to get the required amount of oxygen to the muscles, making aerobic performance less efficient.
- Award [0] for an answer not worthy of credit.  
Award [1] for an acceptable argument as to why endurance athletes should not smoke tobacco.

The quality of written communication is moderate. A range of specialist terms is used with facility and spelling, punctuation and grammar are reasonably good.

E.g. Carbon monoxide from the tobacco smoke takes the place of oxygen in the red blood cells.

Award [2] for an acceptable argument with a clear and competent explanation as to why endurance athletes should not smoke tobacco.

The quality of written communication is very good. A wide range of specialist terms is used adeptly and spelling, punctuation and grammar are almost faultless.

E.g. Carbon monoxide from the tobacco smoke takes the place of oxygen in the red blood cells. This means there is less oxygen available than before.

For a set work rate the heart would have to beat faster than before to get the required amount of oxygen to the muscles, making aerobic performance less efficient.

(3 × [2])

[6]

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MARKS

6

- 19 (a)** Muscular power is about being able to produce maximum force, or a considerable force, with speed in an explosive effort.  
It would therefore be important to develop muscular power for performing the high jump because the take-off, in particular, requires the high jumper to produce maximum force, or a considerable force, with speed in an explosive effort.  
Award [0] for an answer not worthy of credit.  
Award [1] for an explanation that has some merit as to why muscular power would be important.  
E.g. The take-off in high jump requires muscular power. It requires strength with speed.  
Award [2] for a clear and precise explanation as to why muscular power would be important.  
E.g. Muscular power is about being able to produce maximum force, or a considerable force, with speed in an explosive effort.  
It would therefore be important to develop muscular power for performing the high jump because the take-off, in particular, requires the high jumper to produce maximum force, or a considerable force, with speed in an explosive effort. [2]
- (b)** Aerobic fitness is about being able to keep going at activities such as running, cycling, swimming or rowing for long periods of time without getting tired.  
It would therefore not be important to develop aerobic fitness for performing the high jump because the run-up is short and takes no more than 5–8 seconds to complete. There is also considerable rest between jumps.  
Award [0] for an answer not worthy of credit.  
Award [1] for an explanation that has some merit as to why aerobic fitness would not be important.  
E.g. Aerobic fitness would not be important for performing the high jump because the run-up is short and takes no more than 5–8 seconds to complete.  
Award [2] for a clear and precise explanation as to why aerobic fitness would not be important.  
E.g. Aerobic fitness is about being able to keep going at activities such as running, cycling, swimming or rowing for long periods of time without getting tired.  
It would therefore not be important to develop aerobic fitness for performing the high jump because the run-up is short and takes no more than 5–8 seconds to complete. There is also considerable rest between jumps. [2]

4

**20** Example answers.

If fitness testing is to be valid and reliable and allow results to be compared objectively then there are certain principles that must be followed.

- The tests selected should be suitable for the purpose. If you want to assess aerobic fitness then the test must be able to do that. If you want to assess flexibility then the test must be able to do that. It would not be fair if a test did not assess the desired component of fitness and its results were compared with a test that did.
- The protocol (procedures and rules) for the tests must be clear and be followed strictly. It would not be fair to compare results if the test was done differently on separate occasions.
- The administrators of the tests must ensure that the protocol is followed strictly and that they measure, time or count accurately. It would not be fair to compare the results if this was not done.
- For an individual, the same tests should be used before, during and after the training programme. If you want to measure your progress or to judge the effectiveness of your training programme then the same tests must be used on all occasions to allow a fair comparison of results to be made.
- The same tests should be used if you wish to analyse and compare the results achieved by different individuals and groups. The same tests must be used on all occasions and the same protocol strictly followed to allow a fair comparison of results to be made.
- The tests should be carried out under the same, or similar conditions, each time they are used. It would not be fair to compare the results of a 10 × 5 m sprint test if one time the test was performed inside on a non-slip floor and the next time performed outside on wet slippery grass.

Award [0] for an answer not worthy of credit.

Award [1] for a basic explanation of a principle that would provide valid and reliable fitness testing, so that the results can be compared.

The quality of written communication is moderate. A range of specialist terms is used with facility and spelling, punctuation and grammar are reasonably good.

E.g. The tests selected should be suitable for the purpose.

Award [2] for a clear and detailed explanation of a principle that would provide valid and reliable fitness testing, so that the results can be compared.

The quality of written communication is very good. A wide range of specialist terms is used adeptly and spelling, punctuation and grammar are almost faultless.

E.g. The tests selected should be suitable for the purpose. If you want to assess aerobic fitness then the test must be able to do that. If you want to assess flexibility then the test must be able to do that. It would not be fair to compare results if this did not happen.

(4 × [2])

[8]

8

**21 (a)** Example answer for a passive, static flexibility exercise.

Person 'A' should sit on the floor with legs stretched out. Keeping their legs straight, Person 'A' should reach for their toes. Person 'B' should stand behind Person 'A' and put their hands on Person A's shoulders. Person 'B' should slowly press down on Person A's shoulders. The force supplied by Person 'B' should help stretch Person A's hamstring muscles. With Person 'B' providing the force, this exercise is therefore a passive static flexibility exercise.

Award [0] for an answer not worthy of credit.

Award [1] for a basic explanation of how a static flexibility exercise for the hamstrings should be performed.

Award [2] for a clear and detailed explanation of how another person provides the force in an appropriate passive static flexibility exercise for the hamstrings.

[2]

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- (b) Award [0] for an answer not worthy of credit.  
Award [1] for an acceptable drawing that shows how the static flexibility exercise in (a) should be performed.  
Award [2] for a clear drawing that shows how the appropriate passive static flexibility exercise in (a) should be performed with the help of another person. [2]
- (c) Example answer for an active, static flexibility exercise.  
Person 'C' should balance on one foot. They may use a wall or other object to help them balance. They should bend the other leg at the knee and take hold of the ankle with their hand. Keeping both knees together they should pull on their ankle to further bend their leg and at the same time push their hips forward. This action should stretch the quadriceps muscles. With Person 'C' providing the force it is therefore an active, static flexibility exercise.  
Award [0] for an answer not worthy of credit.  
Award [1] for a basic explanation of how a static flexibility exercise for the quadriceps should be performed.  
Award [2] for a clear and detailed explanation of how an appropriate active static flexibility exercise for the quadriceps should be performed. [2]
- (d) Award [0] for an answer not worthy of credit.  
Award [1] for an acceptable drawing that shows how the static flexibility exercise in (c) should be performed.  
Award [2] for a clear drawing that shows how the appropriate active static flexibility exercise in (c) should be performed. [2]

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- 22 (a) Example answers.  
Advantages of having swimming as the aerobic activity as opposed to having running:
- With swimming the body weight is supported by the water, so there is less chance of impact injuries occurring, whereas with running, especially on the roads, it is high impact and there is more chance of developing ankle, knee or hip injuries.
  - With indoor swimming the weather does not affect participation. The environment of the pool will be similar each visit throughout the year, whereas with running, the weather can make it uncomfortable, dangerous or even unsafe to run (icy roads).
  - There is very little expense needed for the kit needed for swimming, i.e. a swimsuit, goggles and towel whereas with running you need running shoes, socks, shorts, tracksuit and a waterproof/windproof top.
  - With swimming in an indoor pool, the swimmers should have safe, supervised participation, whereas with running there is a greater risk of being involved in an accident, for example, twisting an ankle or being involved in a road traffic accident.
- Award [0] for an answer not worthy of credit.  
Award [1] for an acceptable advantage of having swimming as opposed to running.  
E.g. With swimming the body weight is supported by the water.  
Award [2] for a clear and detailed explanation of an acceptable advantage of having swimming as opposed to running.  
E.g. With swimming the body weight is supported by the water, so there is less chance of impact injuries occurring, whereas with running, especially on the roads, it is high impact and there is more chance of developing ankle, knee or hip injuries.  
(2 × [2]) [4]

**(b)** Example answers.

Advantages of having walking as the aerobic activity as opposed to having swimming:

- Walking can be done from home, work or wherever you are, as it needs no specialist facilities, whereas with swimming you need access to a swimming pool or to a body of water.
- Walking is free, whereas with swimming you usually have to pay to use the facility.
- Walking can be done at any time, day or night, whereas with swimming you need the pool to be open and the pool to be available at that time.
- Walking can be done in normal day clothes or sportswear with the body being covered, whereas with swimming the body is exposed and this is an embarrassment for many people, so they will not go swimming.
- With walking you can talk to others therefore there is a social aspect whereas when swimming this is more difficult.
- Most able-bodied people can walk, whereas not everyone can swim and some people have a fear of water.

Award [0] for an answer not worthy of credit.

Award [1] for an acceptable advantage of having walking as opposed to swimming.

E.g. Walking can be done from home, work or wherever you are.

Award [2] for a clear and detailed explanation of an acceptable advantage of having walking as opposed to swimming.

E.g. Walking can be done from home, work or wherever you are, as it needs no specialist facilities, whereas with swimming you need access to a swimming pool or to a body of water.

(2 × [2])

[4]

8

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23 (a)

Interval training workout to develop anaerobic fitness	Interval training workout to develop aerobic fitness
Intensity: 95% MHR Must be higher than the aerobic intensity and be within the range 90% – 100% MHR.	Intensity: 85% MHR Must be lower than the anaerobic intensity and be within the range 80% – 90% MHR.
Time: 30 seconds Must be less than the aerobic. Must be appropriate for the intensity, i.e. the higher the intensity; the shorter the time. Should usually be within the range of 60–10 seconds.	Time: 80 seconds Must be longer than the anaerobic. Must be appropriate for the intensity, i.e. the higher the intensity; the shorter the time. Should usually be within the range of 120–60 seconds.
Number of repetitions: 7 reps Must be less than the aerobic. Must be appropriate for the intensity and time, i.e. high intensity and time will mean fewer repetitions. (e.g. 9–3)	Number of repetitions: 12 reps Must be more than the anaerobic. Must be appropriate for the intensity and time, i.e. higher intensity and time will mean fewer repetitions. (e.g. 15–10)

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Award [0] for an answer not worthy of credit.

Award [1] for a precise and appropriate choice, for each of intensity, time and number of repetitions for the two workouts.

(6 × [1])

[6]

(b) (i) **Intensity**

Example answer.

I chose 95% of MHR for the anaerobic intensity and 85% of MHR for the aerobic intensity.

The anaerobic threshold is reached when the body can no longer deliver sufficient oxygen and nutrients to the working muscles to allow them to work at the intensity required by the activity.

This means the intensity for the anaerobic interval training must be near maximum effort. The person needs to work between 90% and 100% of MHR to ensure that they are working anaerobically, therefore my choice of 95% of MHR is suitable as it is near maximum effort. The aerobic intensity must be lower than the anaerobic threshold and within the range of 80–90% of MHR (upper end of range). As it is interval training, where the person gets periods of rest/recovery between work times, the intensity should be reasonably high and closer to the anaerobic threshold than the aerobic threshold. By choosing 85% of MHR the person will be working aerobically, but reasonably hard.

Award [0] for an answer not worthy of credit.

Award [1] for an answer that to some degree accounts for the differences between the intensities chosen for the anaerobic and aerobic interval training workouts.

The quality of written communication is limited. A limited range of specialist terms is used and spelling, punctuation and grammar are weak.

Award [2] for an answer that gives a sound explanation for the differences between the intensities and the explanation is linked to an understanding of anaerobic and aerobic interval training workouts.

The quality of written communication is moderate. A range of specialist terms is used with facility and spelling, punctuation and grammar are reasonably good.

E.g.

Anaerobic: near maximum effort; working without oxygen, so very high intensity. Aerobic: lower intensity than anaerobic working with oxygen, so working at reasonably hard (upper end of range).

Award [3] for an answer that gives a sound explanation for the differences between the intensities and the explanation is clearly linked to the expectations for anaerobic and aerobic interval training workouts. This is confirmed with their choice of intensities. The quality of written communication is very good. A wider range of specialist terms is used adeptly and spelling, punctuation and grammar are almost faultless.

E.g.

Anaerobic: near maximum effort so working without oxygen at 90–100% of MHR. Aerobic: lower intensity than anaerobic working with oxygen, so 80–90% of MHR (upper end of range). I chose 95% of MHR for the anaerobic workout because anaerobic training requires near maximum or maximum effort (very high intensity). I chose 85% of MHR for the aerobic workout because this is working relatively hard but aerobically at the upper end of the range (80–90% of MHR). [3]

**(ii) Time**

Example answer.

I chose 30 seconds for the anaerobic intervals and 80 seconds for the aerobic intervals.

As the anaerobic intensity of 95% of MHR is near maximum effort, this cannot be maintained for too long. I wanted to push the person, so the time chosen for each interval in the anaerobic workout was 30 seconds. The range of times for developing anaerobic fitness ranges from 10–60 seconds.

As the aerobic intensity of 85% of MHR is a reasonably hard effort, but still aerobic, the work time will be longer to develop aerobic fitness. As the intensity was considered reasonably hard, the time chosen for each interval in the aerobic workout was 80 seconds. The range of times for developing aerobic fitness ranges from 60–120 seconds.

Award [0] for an answer not worthy of credit.

Award [1] for an answer that to some degree accounts for the differences between the times chosen for the anaerobic and aerobic interval training workouts.

The quality of written communication is limited. A limited range of specialist terms is used and spelling, punctuation and grammar are weak.

Award [2] for an answer that gives a sound explanation for the differences between the work times and the explanation is lined to an understanding of the intensities for anaerobic and aerobic interval training workouts.

The quality of written communication is moderate. A range of specialist terms is used with facility and spelling, punctuation and grammar are reasonably good.

E.g.

Anaerobic intensity: 95% MHR or near maximum effort. This means a shorter work time for the anaerobic intervals (10–60 seconds). Aerobic intensity: 85% MHR, or a reasonably hard effort. As it is still working aerobically, this allows a longer work time for the intervals (60–120 seconds).

Award [3] for an answer that gives a sound explanation for the differences between the times for the anaerobic and aerobic intervals and the explanation is clearly linked to having appropriate intensities for anaerobic and aerobic interval training workouts. This is confirmed with their choice of times for the anaerobic and aerobic workouts. The

quality of written communication is very good. A wide range of specialist terms is used adeptly and spelling, punctuation and grammar are almost faultless.

E.g.

Anaerobic intensity: 95% MHR or near maximum effort. This means you need a short work time for the anaerobic intervals (10–60 seconds). I chose 30 seconds as the work time for the anaerobic workout because of the high intensity of 95% MHR.

Aerobic intensity: 85% MHR, or a reasonably hard effort. This allows a longer work time for the intervals (60–120 seconds). I chose 60 seconds as the work time for the aerobic workout because they can do this aerobically, but they are being pushed at 85% of MHR. [3]

### (iii) Number of Repetitions

Example answer.

I chose 7 repetitions for the anaerobic workout and 15 repetitions for the aerobic workout.

As the person who is doing the anaerobic workout is working at near maximum effort (95% of MHR) for 30 seconds, the person will not be able to do too many repetitions. However, with interval training for anaerobic fitness they get a rest to work ratio of 4:1, so to push them and develop anaerobic fitness I chose 7 repetitions. The range is usually between 3–9 repetitions.

The person doing the aerobic workout is working aerobically at a lower intensity (85% of MHR) so they can work for longer (60 seconds) and as they also get a rest between each repetition (ratio of 1:1) they can do many more repetitions. I chose 12 repetitions for the aerobic workout to make it demanding. The range is usually between 10–15 repetitions.

Award [0] for an answer not worthy of credit.

Award [1] for an answer that to some degree accounts for the differences between the number of repetitions chosen for the anaerobic and aerobic interval training workouts.

The quality of written communication is limited. A limited range of specialist terms is used and spelling, punctuation and grammar are weak.

Award [2] for an answer that gives a sound explanation for the differences between the number of repetitions and the explanation is linked to an understanding of the intensities and work times for anaerobic and aerobic interval training workouts.

The quality of written communication is moderate. A range of specialist terms is used with facility and spelling, punctuation and grammar are reasonably good.

E.g.

Anaerobic intensity: 95% MHR which is near maximum effort with a work time of 30 seconds. This means there will not be too many repetitions for the anaerobic intervals (3–9 repetitions). Aerobic intensity: 85% MHR, which is working reasonably hard aerobically for a work time of 60 seconds. This means there will be more repetitions for the aerobic intervals (10–15 repetitions).

Award [3] for an answer that gives a sound explanation for the differences between the number of repetitions and the explanation is clearly linked to having appropriate intensities, work times and rest times for anaerobic and aerobic interval training workouts. This is confirmed with their choice of number of repetitions for anaerobic and aerobic workouts.

The quality of written communication is very good. A wide range of specialist terms is used adeptly and spelling, punctuation and grammar are almost faultless.

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E.g.

Anaerobic intensity: 95% MHR which is near maximum effort with a work time of 30 seconds. This means the person will not be able to do too many repetitions for the anaerobic intervals (3–9 repetitions). I chose 7 as the number of repetitions for the anaerobic workout because the intensity of the work is very high (95% MHR) and it is for 30 seconds. Also in interval training you get a rest between repetitions. For anaerobic workouts, the ratio of rest to work is 4:1, so to work them hard I chose 7 repetitions.

Aerobic intensity: 85% MHR, which is working reasonably hard aerobically for a work time of 60 seconds. This allows more repetitions for the aerobic intervals (10–15 repetitions).

I chose 15 as the number of repetitions for the aerobic workout because the intensity is reasonably hard (85% MHR) and the time is 60 seconds. Also in interval training you get a rest between repetitions. For aerobic the ratio of rest to work is 1:1, so to work them hard I chose 15 repetitions.

[3]

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15

**24 (a) (i) Weights**

If the weight was 10kg for 5RM then the weights of 15kg for 10RM and 20kg for 15RM would be too heavy for the RMs and would be impossible to use. The weight should decrease as the RM increases. In other words, if the weight is 10kg for 5RM then the weight for 10RM will be less than 10kg.

Award [0] for an answer not worthy of credit.

Award [1] for a partial understanding of the appropriateness of the weights given for the RMs over the 9 weeks.

E.g. If the weight was 10kg for 5RM then the weights of 15kg for 10RM and 20kg for 15RM would be too heavy for the RMs and would be impossible to use.

Award [2] for a clear understanding of the appropriateness of the weights given for the RMs over the 9 weeks and, if needed, for giving acceptable alternatives.

E.g. If the weight was 10kg for 5RM then the weights of 15kg for 10RM and 20kg for 15RM would be too heavy for the RMs and would be impossible to use. The weight should decrease as the RM increases.

In other words, if the weight is 10kg for 5RM then the weight for 10RM will be less than 10kg. [2]

**(ii) Repetition Maximums**

To develop muscular endurance the RMs should be within the range of 13RM–25RM.

The RMs given for weeks 1–3 and for weeks 4–6 would develop muscular power (5RM) and muscular strength (10RM) rather than muscular endurance. The RM for weeks 7–9 (15RM) would develop muscular endurance.

Award [0] for an answer not worthy of credit.

Award [1] for a partial understanding of the appropriateness of the RMs over the 9 weeks.

E.g. The RMs given for weeks 1–3 and for weeks 4–6 would not develop muscular endurance.

Award [2] for a clear understanding of the appropriateness of the RMs over the 9 weeks.

E.g. The RMs given for weeks 1–3 and for weeks 4–6 would develop muscular power (5RM) and muscular strength (10RM) rather than muscular endurance. To develop muscular endurance the RMs should be within the range of 13RM–25RM. The RM for weeks 7–9 (15RM) would develop muscular endurance. [2]

**(b) (i) Number of repetitions**

In weeks 1–3 the RM is 25 and the number of repetitions is 15. This number of repetitions may be too low for 25 RM. It would be better to increase the number of repetitions to 20 or more.

In weeks 4–6 the RM is 20 and the number of repetitions is 20. This number of repetitions is the maximum possible for 20RM. If more than one set is to be done it would be better to decrease the number of repetitions slightly, for example, to 17 repetitions.

In weeks 7–9 the RM is 15 and the number of repetitions is 25. This number of repetitions is impossible to do with 15RM. It would be necessary to decrease the number of repetitions considerably, for example, to 13 repetitions.

Award [0] for an answer not worthy of credit.

Award [1] for a partial understanding of the appropriateness of the number of repetitions for the RMs over the 9 weeks.

E.g. In weeks 7–9 the RM is 15 and the number of repetitions is 25. This number of repetitions is impossible to do with 15RM.

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Award [2] for a clear understanding of the appropriateness of the number of repetitions for the RMs over the 9 weeks.  
 E.g. In weeks 1–3 the RM is 25 and the number of repetitions is 15. This number of repetitions may be too low for 25RM. It would be better to increase the number of repetitions to 20 or more.  
 In weeks 4–6 the RM is 20 and the number of repetitions is 20. This number of repetitions is the maximum possible for 20RM. If more than one set is to be done it would be better to decrease the number of repetitions slightly, for example, to 17 repetitions.  
 In weeks 7–9 the RM is 15 and the number of repetitions is 25. This number of repetitions is impossible to do with 15RM. It would be necessary to decrease the number of repetitions considerably, for example, to 13 repetitions. [2]

(ii) Example answer.

**Repetition Maximums**

The RMs of 25, 20 and 15 over the three phases of the nine weeks are feasible for developing muscular endurance. They are all within the acceptable range of 13RM–25RM. The programme would start with lighter weights (25RM) and gradually increase the weights (20RM then 15RM) but would still develop muscular endurance.

Award [0] for an answer not worthy of credit.

Award [1] for a partial understanding of the appropriateness of the RMs over the 9 weeks.

E.g. The RMs of 25, 20 and 15 over the three phases of the nine weeks are feasible for developing muscular endurance.

Award [2] for a clear understanding of the appropriateness of the RMs over the 9 weeks and, if needed, for giving acceptable alternatives.

E.g. The RMs of 25, 20 and 15 over the three phases of the nine weeks are feasible for developing muscular endurance. They are all within the acceptable range of 13RM–25RM. The programme would start with lighter weights (25RM) and gradually increase the weight (20RM then 15RM) but the weights would still develop muscular endurance. [2]

**Total**

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8

**100**