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Program Support Notes

Grades **7 - 10**

29mins

All Systems Go Again!

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Introduction

'All Systems Go' is a 30 minute insight into how the body uses energy as quickly and as efficiently as possible to produce a variety of complex movements. These can be quick bursts of activity, where an immediate production of energy is provided by the ATP-PC system or more prolonged, endurance events where a constant level of energy is required for a long period of time. The most striking part of this whole concept is that each energy system has an intricate link to the next and in any activity all three systems will be working in perfect harmony.

DVD Timeline

00:00:00 Introduction

00:01:38 Inside our muscles
00:06:16 Summary

00:07:00 The anaerobic energy system
00:11:25 Summary

00:12:13 The aerobic energy system
00:14:53 Summary

00:15:40 Energy systems working together
00:21:07 Summary

00:21:51 Fatigue and recovery
00:27:15 Summary

00:28:01 Conclusion

00:29:00 Credits

00:29:38 End program

Student Worksheet:

Before Viewing the Program

1. Define the term '*energy'*.

2. Energy can be found in chemical form such as the food we eat. State 4 other forms of energy, with examples of each.

3. The energy to perform biological work comes from energy that is stored in the bonds of a number of molecules.

4. What do you understand by the term '*free energy"*?

5. Describe the structure and function of Mitochondria.

While Viewing the Program

Muscles and Their Energy Systems

1. What is the difference between a voluntary muscle and an involuntary muscle? Give an example of each.

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2. Why do muscles contract?

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3. How is the amount of force produced determined?

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4. Describe the detailed structure of muscles. Students can create a diagram with labels to include muscle fibers, myofibrils, myosin, actin etc.

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5. Define ATP and describe its main function.

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6. Describe what you understand by the term '*cross bridges'*.

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7. What are the two main muscle fiber types?

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8. Give a sporting example for each of muscle fiber types. Where would you expect to have a high proportion of that particular muscle fiber?

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9. What happens if you have a high proportion of mitochondria?

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ATP-PC System

10. What does the term *anaerobic* mean?

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11. In the description ATP-PC, what does PC stand for?

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12. Define ADP.

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13. What is the role of PC in this instance?

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14. What is the name of the enzyme which helps in this reaction?

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15. State a time span for this particular energy system. Give 4 examples of sports where the energy for this activity is predominantly provided by this reaction.

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Lactic Acid System

16. What is the name of this reaction?

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17. What do you understand by the term '*glycogen*"?

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18. State a time span for this particular energy system. Give 4 examples of sports where the energy for this activity is predominantly provided by this reaction.

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Aerobic System

19. What does this reaction rely upon?

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20. State a time span for this particular energy system. Give 4 examples of sports where the energy for this activity is predominantly provided by this reaction.

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21. What is the main fuel needed for Aerobic Glycolysis?

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22. What are the main waste products from this reaction?

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23. Why does you heart rate and breathing rate increase whilst you are exercising aerobically?

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24. What is the downside of using fat as the fuel for aerobic glycolysis?

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25. When athletes use the expression '*hitting the wall'*, what do they mean?

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26. What is the last possible fuel source for ATP synthesis when working aerobically?

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Continuum

27. Using relevant examples, describe why just one energy system is not solely used in most team games?

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28. What is the main source of energy for short, high intensity activities that last up to 30 seconds?

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29. Draw and describe a graph for the provision of ATP during a 100 meter sprint. Show the interplay between the three main energy systems – *Aerobic – Lactic Acid & - ATP-PC* as lines on your graph.

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30. Draw a graph to represent the level of oxygen consumption from the start of sub-maximal exercise to the end and then throughout recovery.

31. Define the term $VO_{2\ max}$ and state the units it is measured in.

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32. What are the average levels for $VO_{2\ max}$ for an average sedentary male and an elite endurance athlete?

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33. Calculate your maximum heart rate in beats per minute. Now work out how many beats per minute you would have to be working at, to exercise at 85% of your heart rate max.

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Fatigue

34. What is the role of the Central Nervous System in fatigue?

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35. Why are elite endurance athletes able to continue further than a sedentary person with physical activities?

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36. Why does lactic acid build up in the muscles as a result of exercise?

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37. What is '*hypoglycaemia*"?

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38. What effect does the size of muscle groups have on recovery time?

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39. What are the main effects of overtraining on an athlete?

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40. Why is a warm down important?

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After Viewing the Program

1. Describe the sort of food that you would ideally eat 3 hours before a Marathon. Use as many examples as possible.

2. (EXT) What is the reason for the difference in color between muscle fiber types?

3. Draw and describe a graph for the provision of ATP during a full length game of Rugby Union. Show the interplay between the three main energy systems – *Aerobic – Lactic Acid & - ATP-PC* as lines on your graph.