



ANSWER BOOK

Exercise, sports medicine and performance-enhancing drugs

Respiration and cellular energy · Unit B12

Edexcel A 7.13, 7.14, 7.15

12 questions · 42 marks

NAVY EDITION

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SECTION A · Short, 1 to 2 marks

A1 ESM-Q1 **B1** wear and tear on joints, such as wearing away of the articular cartilage, [2]
leading to osteoarthritis, or damage to ligaments, menisci or tendons. **B1** suppression of
the immune system after prolonged intense exercise, giving a higher risk of infections
such as upper respiratory tract infections.

A2 ESM-Q7 **M1** finishers $225 \div 1500 = 15$ per cent; non-runners $20 \div 500 = 4$ per cent. **A1** $15 \div$ [2]
 $4 = 3.75$ times (accept 3.8).

SECTION B · Standard, 3 to 5 marks

B1 ESM-Q2 **B1** less energy is used each day, so with the same diet more is stored as fat [4]
and the person is more likely to become obese. **B1** contracting muscle takes up glucose
from the blood, moving glucose transporters into its membrane without needing
insulin, so less glucose is removed when muscles are inactive. **B1** without regular
exercise, and with obesity, muscle and liver cells become less sensitive to insulin
(insulin resistance). **B1** the pancreas must secrete more insulin to control blood
glucose, and when its β cells cannot keep up the blood glucose concentration stays
high.

B2 ESM-Q3 **B1** the ends of the femur and tibia are covered with articular cartilage, which [4]
reduces friction and absorbs shock. **B1** repeated impact loading wears the cartilage
thin, and the menisci that spread the load can be torn. **B1** once the cartilage is worn the
bone surfaces rub, causing pain, swelling and stiffness, which is osteoarthritis. **B1**
cartilage has no blood supply, so few nutrients and cells reach it and it repairs slowly
and poorly.

B3 ESM-Q9 **B1** the arthroscope and instruments go in through two or three small incisions [4]
rather than one long cut. **B1** less skin, muscle and other tissue is cut, so there is less to
heal, less pain and less blood loss. **B1** the smaller wound gives a lower risk of infection.
B1 she can go home sooner and start moving the joint and rehabilitation earlier, so less
muscle wastes.

B4 ESM-Q11 **B1** being lipid-soluble, they diffuse through the phospholipid bilayer of the [4]
muscle cell membrane. **B1** they bind a receptor protein inside the cell, and the
hormone-receptor complex enters the nucleus. **B1** the complex acts as a transcription
factor, binding DNA and switching on the genes for muscle proteins. **B1** more mRNA is
transcribed and translated, so more muscle protein is made and the fibres grow larger
and stronger.

- B5** **B1** EPO stimulates the bone marrow to produce more red blood cells. **B1** so the blood carries more haemoglobin and more oxygen per litre to the muscles. **B1** aerobic respiration can supply ATP at a higher rate, so the cyclist relies less on anaerobic respiration and builds up less lactate, delaying fatigue. **B1** the blood becomes thicker and more viscous, raising the risk of clots, stroke and heart attack, especially when dehydrated. [4]
ESM-Q12
- B6** **B1** moderate exercise lowers the risk below that of a sedentary person, the lowest point of the curve. **B1** very heavy or prolonged intense exercise raises the risk above that of a sedentary person. **B1** after intense exercise there are fewer, or less active, lymphocytes such as natural killer cells in the blood, or less phagocyte activity, or less IgA in saliva, or raised cortisol suppressing the immune response. [3]
ESM-Q4
- B7** **B1** the finishers spent the race and its build-up in crowds, and travelled, so were more exposed to pathogens. **B1** symptoms were self-reported rather than confirmed in a laboratory, and runners who expect to fall ill may report minor symptoms more often. **B1** the two groups were not allocated at random and differ in other ways, such as sleep, diet or training load before the race, which are confounding variables. [3]
ESM-Q8
- B8** **B1** it is attached to the residual limb by a socket moulded to fit, which spreads the load and transmits force to the blade. **B1** the curved blade bends when the athlete's weight comes onto it, storing elastic strain energy. **B1** it springs back as the foot leaves the ground, returning much of that energy to propel the athlete forward. [3]
ESM-Q10
- B9** **B1** the tent works through the body's own response: low blood oxygen makes the kidneys secrete more of the athlete's own EPO. **B1** that response stops once blood oxygen recovers, so the red cell count stays within a natural range and the health risk is small. **B1** injected EPO has no such limit and can make the blood dangerously viscous, so it meets the criteria of enhancing performance, risking health and being against the spirit of sport. [3]
ESM-Q14

SECTION C · Long, 6 marks or more

C1

ESM-Q13

B1 against, rights and duties: athletes have agreed to the rules of their sport and doping breaks them, so it is cheating. **B1** against, harm: the substances carry health risks, such as liver damage and heart disease from steroids or clots from EPO, and doses exceed medical ones. **B1** against, coercion or virtue ethics: clean athletes are pressured to dope to compete, and doping replaces fair play and effort, setting a poor example to young athletes. **B1** for, autonomy: informed adults should be free to take risks with their own bodies. **B1** for, relativist or utilitarian: the line is arbitrary, since altitude training has a similar effect to EPO legally, and supervised legal use might cause less harm than covert use that testing misses. **B1** a reasoned conclusion that weighs the two sides, for example that coercion removes the autonomy the main argument for doping relies on.

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