1.22 Hormonal Coordination and Homeostasis: 1-hour Pack

AQA 8464 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 The menstrual cycle is controlled by a number of hormones, released mainly by the pituitary gland and the ovaries.

(a) Name the hormone, released by the pituitary gland, that causes an egg to mature in the ovary. **(1)**

(b) Name the hormone, also released by the pituitary gland, that stimulates ovulation, the release of a mature egg from the ovary. **(1)**

(c) State where in the body oestrogen is produced. **(1)**

(d) Name the hormone that maintains the lining of the uterus (womb) during the second half of the menstrual cycle. **(1)**

(e) Describe what happens to the level of progesterone if the egg released is not fertilised, and explain the effect this has on the lining of the uterus. **(2)**

(Total for Question 1 is 6 marks)

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2 Hormones can be used to reduce fertility, for example in the combined contraceptive pill.

(a) Name the two hormones contained in the combined contraceptive pill. **(2)**

(b) Explain how these hormones in the combined pill help to prevent pregnancy. **(2)**

(Total for Question 2 is 4 marks)

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3 In vitro fertilisation (IVF) can be used to help people who are struggling to conceive naturally.

(a) Name the two hormones given to a woman before her eggs are collected during IVF treatment, and state why they are given. **(2)**

(b) Describe what happens to the resulting embryo(s) before pregnancy can begin. **(1)**

(c) Give one social, ethical or economic issue associated with IVF treatment. **(1)**

(Total for Question 3 is 4 marks)

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4 Idris has type 1 diabetes. He measured his blood glucose concentration before and after a 30-minute run.

Before the run: 9.6 mmol/L
Immediately after the run: 5.4 mmol/L

(a) Calculate the fall in Idris's blood glucose concentration caused by the run. **(1)**

(b) Calculate this fall as a percentage of his blood glucose concentration before the run. **(2)**

(c) Suggest, in terms of respiration in muscle cells, why Idris's blood glucose concentration fell during the run. **(2)**

(d) Idris's blood glucose concentration of 5.4 mmol/L after the run is close to the lower end of the normal range. Explain one risk to Idris if he does not eat some carbohydrate soon after finishing his run, and state what he should do to reduce this risk. **(3)**

(Total for Question 4 is 8 marks)

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5 Diabetes is a condition in which a person's blood glucose concentration is not properly controlled.

(a) State the cause of type 1 diabetes. **(1)**

(b) State how type 1 diabetes is usually treated. **(1)**

(c) State the cause of type 2 diabetes. **(1)**

(d) Give two risk factors linked to the development of type 2 diabetes. **(2)**

(e) Suggest one way that type 2 diabetes can often be managed without using insulin injections. **(1)**

(Total for Question 5 is 6 marks)

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6 A nurse measured the blood glucose concentration of two patients every 30 minutes after they had eaten the same meal. Patient 1 does not have diabetes. Patient 2 has type 2 diabetes.

Time after meal (minutes)	Patient 1 (mmol/L)	Patient 2 (mmol/L)
0	5.2	6.8
30	8.6	11.4
60	6.9	12.6
90	5.4	10.8
120	5.1	9.7

(a) Calculate the increase in blood glucose concentration between 0 and 30 minutes for Patient 2. **(1)**

(b) Describe one difference between the two patients' blood glucose concentration curves, using the data in the table. **(1)**

(c) Explain, in terms of insulin, why Patient 2's blood glucose concentration takes much longer to return to a normal level than Patient 1's. **(2)**

(Total for Question 6 is 4 marks)

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7 A health survey recorded the percentage of adults with type 2 diabetes in a UK city, grouped by body mass index (BMI) category.

BMI category	Percentage with type 2 diabetes
Healthy weight	3%
Overweight	9%
Obese	18%

(a) Calculate how many times greater the percentage of adults with type 2 diabetes is in the 'obese' category than in the 'healthy weight' category. **(2)**

(b) A newspaper reported the headline: 'Being overweight causes type 2 diabetes, data proves'. Evaluate whether this data alone proves that being overweight causes type 2 diabetes. **(2)**

(Total for Question 7 is 4 marks)

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8 A clinic gives patients the following information to help them choose a method of contraception.

Contraceptive implant: a small rod inserted under the skin of the arm, releasing progesterone; lasts up to three years without further action needed; over 99% effective; does not protect against sexually transmitted infections (STIs); some users report irregular bleeding as a side effect; fertility usually returns quickly after removal.

Male condom: used during intercourse; about 98% effective with perfect use, about 82% effective with typical use; the only common method that also protects against most STIs; no hormonal side effects; must be used correctly every time, and a new one is needed for each act of intercourse.

Compare the contraceptive implant with the male condom as methods of contraception, and evaluate which might be more suitable for a couple who want a long-term method that they do not need to think about often, and who are not concerned about the risk of STIs.

(Total for Question 8 is 6 marks)

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9 Higher tier only. Femi has an underactive thyroid gland (hypothyroidism) and takes a daily dose of thyroxine medication. Her doctor measured the concentration of TSH (thyroid-stimulating hormone) in her blood before she started treatment, and again three months after starting treatment.

Before treatment: TSH concentration high, thyroxine concentration low.
After three months of treatment: TSH concentration close to normal, thyroxine concentration close to normal.

(a) Name the gland that releases TSH. **(1)**

(b) Explain why Femi's TSH concentration was high before she started taking thyroxine medication. **(1)**

(c) Explain, using ideas about negative feedback, why Femi's TSH concentration fell back towards normal after three months of taking thyroxine medication. **(3)**

(Total for Question 9 is 5 marks)

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Mark scheme · 1.22 Hormonal Coordination and Homeostasis: 1-hour Pack

Question 1

(a) FSH (follicle-stimulating hormone) **B1**

(a) Answer: FSH (follicle-stimulating hormone).

(b) LH (luteinising hormone) **B1**

(b) Answer: LH (luteinising hormone).

(c) the ovaries **B1**

(c) Answer: The ovaries.

(d) progesterone **B1**

(d) Answer: Progesterone.

(e) the level of progesterone falls, as the corpus luteum breaks down, oe **B1**

(e) this causes the lining of the uterus to break down, and it is lost/shed from the body (menstruation, a period), oe **B1**

(e) Answer: If the egg is not fertilised, the level of progesterone falls as the corpus luteum breaks down. This causes the lining of the uterus to break down and be shed from the body, as a period.

Question 2

(a) oestrogen **B1**

(a) progesterone **B1**

(a) Answer: Oestrogen and progesterone.

(b) they inhibit (stop/reduce) the release of FSH from the pituitary gland, oe **B1**

(b) so no eggs mature and are released from the ovaries, meaning fertilisation cannot occur, oe **B1**

(b) Answer: The hormones inhibit the release of FSH from the pituitary gland, so no eggs mature and are released from the ovaries, meaning fertilisation cannot occur.

Question 3

(a) FSH and LH (accept either or both named) **B1**

(a) to stimulate the ovaries to produce/mature several eggs at the same time, oe **B1**

(a) Answer: FSH and LH, given to stimulate the ovaries to produce and mature several eggs at the same time.

(b) one or more embryos are inserted/transferred into the mother's uterus (womb), oe **B1**

(b) Answer: One or more of the embryos are transferred into the mother's uterus (womb).

(c) any valid issue, e.g. it is expensive/not always funded by public healthcare, it has a relatively low success rate and can cause emotional stress, implanting multiple embryos can lead to multiple births which carry higher risks, or ethical concerns about unused embryos, oe **B1**

(c) Answer: For example, IVF is expensive and not always funded by public healthcare, and it has a relatively low success rate, which can cause considerable emotional stress for patients.

Question 4

(a) 4.2 mmol/L (9.6 - 5.4), cao **B1**

(a) Answer: 4.2 mmol/L

(b) 4.2 / 9.6 x 100, ft from (a) **M1**

(b) 43.75%, or awrt 44%, cao **A1**

(b) Answer: 43.75% (awrt 44%)

(c) his exercising leg muscles needed more energy, so respired at a faster rate, oe **B1**

(c) muscle cells took up more glucose from the blood to use in (aerobic) respiration, lowering his blood glucose concentration, oe **B1**

(c) Answer: His exercising leg muscles needed more energy, so respired at a faster rate, taking up more glucose from the blood to use in aerobic respiration and lowering his blood glucose concentration.

(d) his blood glucose concentration could continue to fall, especially if he still has insulin active in his body from an earlier injection, oe **B1**

(d) this risks hypoglycaemia (dangerously low blood glucose), which can cause symptoms such as shaking, sweating, confusion or dizziness, oe **B1**

(d) he should eat/drink a source of fast-acting carbohydrate soon, to raise his blood glucose concentration back to a safe level, oe **B1**

(d) Answer: His blood glucose concentration could continue to fall, especially if he still has insulin active in his body from an earlier injection, risking hypoglycaemia (dangerously low blood glucose), which can cause symptoms such as shaking, sweating, confusion or dizziness. He should eat or drink a source of fast-acting carbohydrate soon to raise his blood glucose concentration back to a safe level.

Question 5

(a) the pancreas produces little or no insulin, oe **B1**

(a) Answer: The pancreas produces little or no insulin.

(b) insulin injections, or use of an insulin pump, oe **B1**

(b) Answer: With insulin injections, or the use of an insulin pump.

(c) the body's cells no longer respond properly to insulin (insulin resistance), and/or the pancreas does not produce enough insulin, oe **B1**

(c) Answer: The body's cells no longer respond properly to insulin, and/or the pancreas does not produce enough insulin.

(d) any one valid risk factor, e.g. obesity/being overweight, a diet high in sugar and/or fat, or lack of regular exercise **B1**

(d) any second valid risk factor, e.g. increasing age, or a family history of type 2 diabetes **B1**

(d) Answer: Any two of: obesity/being overweight; a diet high in sugar and/or fat; lack of regular exercise; increasing age; a family history of type 2 diabetes.

(e) a carbohydrate-controlled diet, regular exercise, losing weight, or medication other than insulin, oe **B1**

(e) Answer: A carbohydrate-controlled diet, regular exercise, losing weight, or medication other than insulin.

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Question 6

(a) 4.6 mmol/L (11.4 - 6.8), cao **B1**

(a) Answer: 4.6 mmol/L

(b) e.g. Patient 2's blood glucose concentration rises to a higher peak (12.6 mmol/L, compared with 8.6 mmol/L for Patient 1) and takes much longer to fall back down (still 9.7 mmol/L at 120 minutes, compared with 5.1 mmol/L for Patient 1), oe **B1**

(b) Answer: Patient 2's blood glucose concentration rises to a much higher peak (12.6 mmol/L compared with 8.6 mmol/L) and stays high for much longer, still at 9.7 mmol/L after 120 minutes, whereas Patient 1's has returned to close to its starting value.

(c) in type 2 diabetes, the body's cells no longer respond properly to insulin (insulin resistance), and/or the pancreas may not produce enough insulin, oe **B1**

(c) so glucose is taken up from the blood by cells, and converted into glycogen by the liver, much more slowly than normal, keeping blood glucose concentration higher for longer, oe **B1**

(c) Answer: In type 2 diabetes, the body's cells no longer respond properly to insulin, and/or the pancreas does not produce enough insulin, so glucose is removed from the blood much more slowly than normal, keeping blood glucose concentration raised for longer.

Question 7

(a) 18 / 3 **M1**

(a) 6 times (6x) cao **A1**

(a) Answer: 6 times

(b) the data shows a correlation (association) between higher BMI category and a higher percentage of type 2 diabetes, but this alone does not prove that one causes the other, oe **B1**

(b) other factors could also be involved, e.g. diet, exercise levels, age or genetic factors could affect both body weight and diabetes risk, so a controlled study would be needed to establish cause, oe **B1**

(b) Answer: The data shows a correlation between BMI category and type 2 diabetes rates, but correlation alone does not prove causation; other factors, such as diet, exercise, age or genetics, could affect both body weight and diabetes risk, so this data alone does not prove the headline's claim.

Question 8

Level 3 A clear, logically structured comparison of both methods, covering effectiveness, duration of action/convenience and STI protection, leading to a well-reasoned evaluation that directly addresses the couple's stated priorities, using the data given. **5-6**

Level 2 Some accurate comparison of the two methods, covering at least two of effectiveness, convenience and STI protection, but the evaluation is incomplete, one-sided, or not always clearly linked to the couple's situation. **3-4**

Level 1 Basic, isolated statement(s) about one method or one piece of data, with little or no comparison or evaluation. The answer may be a simple list. **1-2**

Indicative content:

- The implant is more effective at preventing pregnancy than the male condom, both compared with perfect use (over 99% vs about 98%) and, more noticeably, compared with typical/everyday use (over 99% vs about 82%).
- The implant lasts up to three years without the user needing to remember to do anything, whereas the condom must be used correctly every single time, which is why its typical-use effectiveness is much lower than its perfect-use effectiveness.
- The implant provides no protection against STIs, whereas the male condom is the only one of the two methods that also protects against most STIs.
- The implant can cause side effects such as irregular bleeding, which the condom does not.
- Because this couple specifically want a long-term method they do not need to think about often, and are not concerned about STI risk, the implant would be more suitable for them, as it removes the need to remember to use contraception at the time of intercourse.
- A balanced answer might note that fertility returns quickly after either method is stopped (the implant is removed, or condom use ends), so neither has a long-term effect on future fertility.

Question 9

(a) pituitary gland **B1**

(a) Answer: The pituitary gland.

(b) her thyroxine concentration was low, so the pituitary gland released more TSH to try to stimulate the thyroid gland to produce more thyroxine (negative feedback response to low thyroxine), oe **B1**

(b) Answer: Her thyroxine concentration was low, so the pituitary gland released more TSH to try to stimulate her thyroid gland to produce more thyroxine, as part of the negative feedback response.

(c) the thyroxine medication raised the concentration of thyroxine in her blood, oe **B1**

(c) the pituitary gland detected this rise in thyroxine concentration and responded by releasing less TSH, oe **B1**

(c) reducing TSH means the (remaining activity of the) thyroid gland is stimulated less, helping to keep her thyroxine concentration close to its normal level, oe **B1**

(c) Answer: The thyroxine medication raised her blood thyroxine concentration. The pituitary gland detected this rise and responded by releasing less TSH, reducing stimulation of her thyroid gland and helping to keep her thyroxine concentration close to normal.

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