

Name: _____

Class teacher: _____

Combined Science

Biology - Paper 2

CB7 Animal Coordination, control and homeostasis

Revision booklet

Response to internal and external change

Controls in the human body	Blood glucose concentration	These automatic control systems may involve nervous responses or chemical responses.
	Body temperature	
	Water levels	

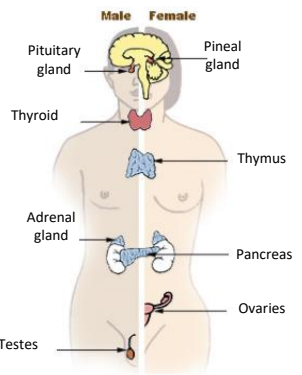
The regulation of internal conditions of a cell or organism to maintain optimum conditions for function.

Homeostasis maintains optimal conditions for enzyme action (thermoregulation) and all cell functions (osmoregulation).

Homeostasis

CB7 BIOLOGY ANIMAL COORDINATION PART 1

Control of blood glucose concentration



Human endocrine system

Endocrine system
 Composed of glands which secrete chemicals called hormones directly into the bloodstream.
 The blood carries the hormone to a target organ where it produces an effect. Compared to the nervous system effects are slower but act for longer.

Pituitary gland
 'Master gland'; secretes several hormones into the blood
 Stimulates other glands to produce hormones to bring about effects.

Blood glucose concentration	
<i>Monitored and controlled by the pancreas</i>	
Too high	(HT only) Too low
Pancreas produces the hormone insulin, glucose moves from the blood into the cells. In liver and muscle cells excess glucose is converted to glycogen for storage.	Pancreas produces the hormone glucagon that causes glycogen to be converted into glucose and released into the blood.

(HT) Rising glucose levels inhibit the release of glucagon in a negative feedback system. Insulin is released to reduce glucose levels and which cause the pancreas to release glucagon

Negative feedback (HT only)	Adrenaline	Produced in adrenal glands, increases breathing/heart rate, blood flow to muscles, stimulates liver to convert glycogen to glucose. Prepares body for 'fight or flight'.
	Thyroxine	Produced in the thyroid gland, stimulates the basal metabolic rate. Important in growth and development.

Increasing thyroxine levels prevent the release of thyroid stimulating hormone which stops the release of thyroxine.

Diabetes	
Type 1	Type 2
Pancreas fails to produce sufficient insulin leading to uncontrolled blood glucose levels. Normally treated by insulin injection.	Obesity is a risk factor. Body cells no longer respond to insulin. Common treatments include changing by diet and increasing exercise.

FSH and LH are used as 'fertility drugs' to help someone become pregnant in the normal way

Hormones are used in Assisted Reproductive Technology (ART) to treat infertility

In Vitro Fertilisation (IVF) treatment.

Involves giving a mother FSH and LH to stimulate the maturation of several eggs (clomifene therapy)

The eggs are collected from the mother and fertilised by sperm from the father in a laboratory.



The fertilised eggs develop into embryos.



At the stage when they are tiny balls of cells, one or two embryos are inserted into the mother's uterus (womb).

The use of hormone to treat infertility (HT only)

CB7 BIOLOGY ANIMAL COORDINATION PART 2

Hormones in human reproduction

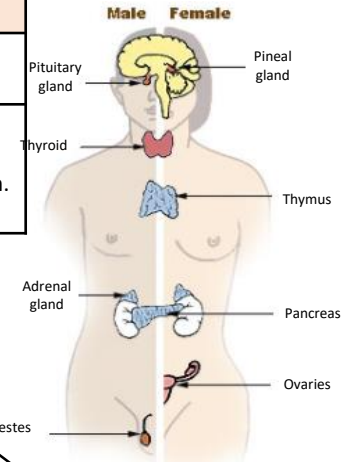
During puberty reproductive hormones cause secondary sexual characteristics to develop

Oestrogen (main female reproductive hormone)

Produced in the ovaries. At puberty eggs begin to mature releasing one every 28 days – **ovulation**.

Testosterone (main male reproductive hormone)

Produced in the testes stimulation sperm production.

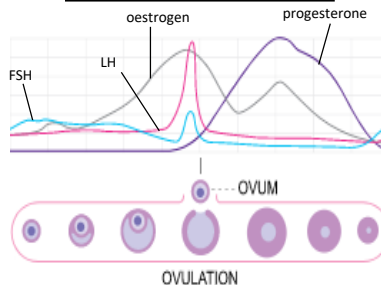


Contraception

Potential disadvantages of IVF

- Emotional and physical stress.
- Success rates are not high.
- Multiple births risk to mother and babies.

(HT only) a graph of hormone levels over time

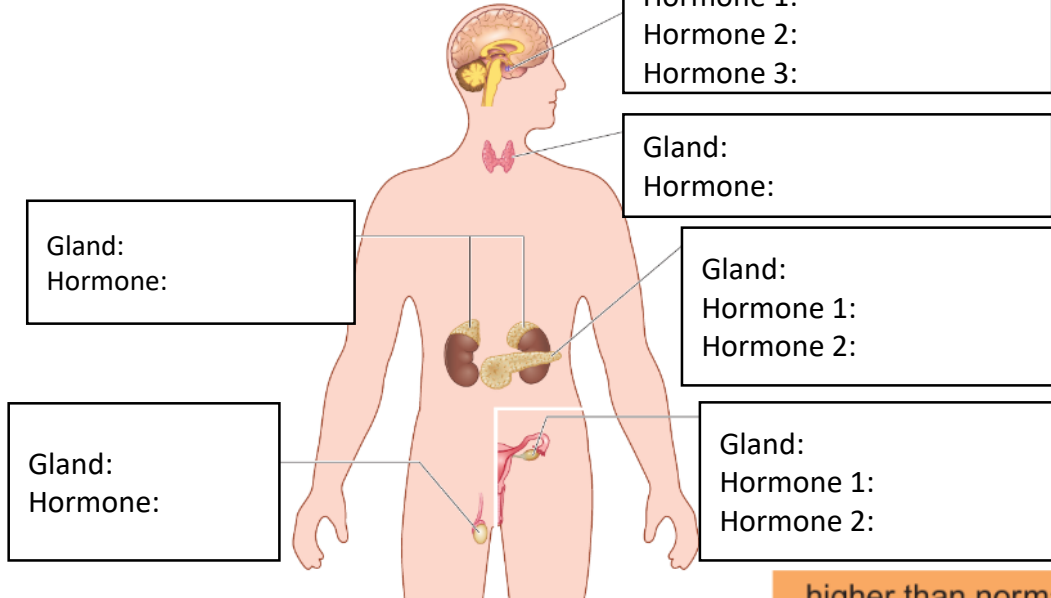


Fertility can be controlled by hormonal and non hormonal methods

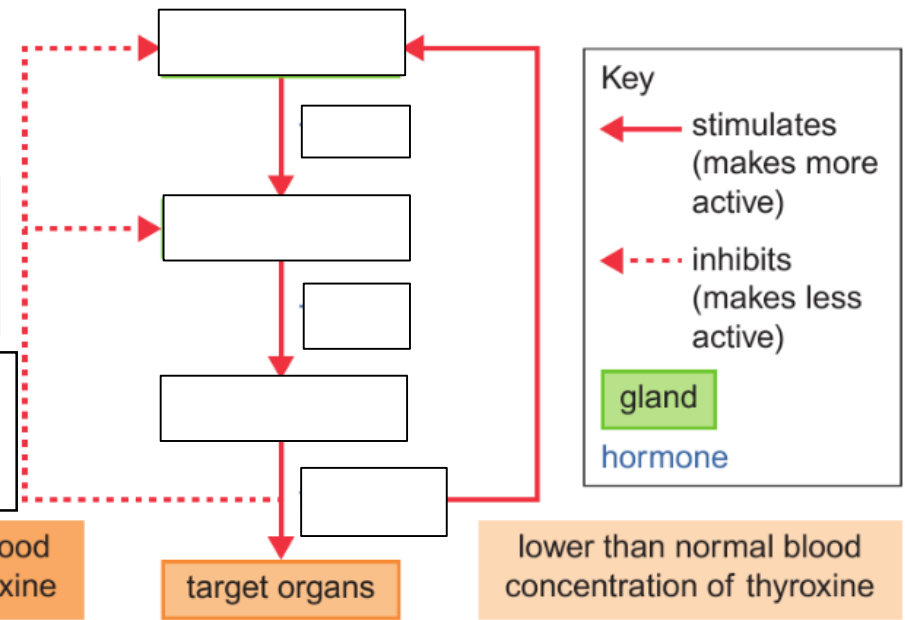
Oral contraceptives	Contain hormones to inhibit FSH production so that no eggs mature.
Injection, implant, skin patch	For slow release of progesterone to inhibit the maturation and release of eggs for months or years.
Barrier methods	Condoms or diaphragms which prevent sperm reaching the egg.
Intrauterine devices	Prevent implantation of an embryo or release a hormone.
Spermicidal agents	Kill or disable sperm.
Surgery	Male or female sterilisation.

Menstrual cycle	Follicle stimulating hormone (FSH)	Causes maturation of an egg in the ovary.	(HT) FSH stimulates ovaries to produce oestrogen.
	Luteinising hormone (LH)	Stimulates release of an egg.	(HT) Oestrogen stops FSH production and stimulates LH production in pituitary gland.
	Oestrogen and progesterone	Maintain uterus lining.	

CB7 Animal coordination, control and homeostasis



Define the term metabolic rate?
Under what conditions would you measure metabolic rate?



Key

- ← stimulates (makes more active)
- ← - - - inhibits (makes less active)
- gland (green box)
- hormone (blue text)

Which are faster, nervous system responses or hormone responses?
Why?

What are the physical effects of hyperthyroidism?
•
•

What are the physical effects of hypothyroidism?
•
•

What is the formula for calculating BMI?
 $BMI = \frac{mass}{height^2}$

Calculate the BMI of a person who is 180 cm tall, and who has a mass of 80 kg.

What is an alternative method of measuring the risk of developing type 2 diabetes?

Target organ	Effects

Fill in the gaps:

1. Low levels of _____ allow _____ to be produced by the _____ gland.
2. _____ causes growth and maturation of the egg.
3. High levels of _____ stimulate the _____ to produce _____.
4. _____ causes the lining of uterus to be built up.
5. High _____ levels cause _____ to be released from the _____ gland.
6. _____ causes ovulation to occur and the Corpus luteum to be formed.
7. The Corpus luteum secretes _____ which maintains the lining of the uterus.
8. This inhibits production of _____ and _____.
9. Falling concentrations of _____ and _____ cause the lining of the uterus to break down (also called _____).

Hormone	Released from...	Target organ
FSH		
LH		
Oestrogen		
Progesterone		

Explain how IVF treatment works (the first 2 stages are clomifene therapy):

- 1.
- 2.
- 3.
- 4.
- 5.

The hormone _____ could be used in female contraceptive pills because _____

On which day of the menstrual cycle is ovulation most likely to occur?

How many days does a menstrual cycle usually last for?

Why is a missed period usually the first sign of a pregnancy (explain using hormones)?

Explain how type 1 diabetes can be controlled.

Explain how type 2 diabetes can be controlled.

What causes type 1 diabetes?

What causes type 2 diabetes?

What is the role of insulin in the body? What is the target organ? What does it cause to happen?

What is the role of glucagon in the body? What is the target organ? What does it cause to happen?

Explain how this is an example of a negative feedback loop.

Suggest how each of these factors would affect the concentration of glucose in the blood;

1. Time since last meal
2. Types of food eaten during the last meal
3. Amount of recent exercise

CB7 Animal coordination, control and homeostasis exam questions (39 marks)

Foundation exam questions

Q1.

What name is given to the process of maintaining the internal body conditions?

(1)

- A respiration
- B diffusion
- C digestion
- D homeostasis

Q2.

Insulin is produced by an endocrine gland and is transported in the blood.

(i) Which row shows the endocrine gland and the target organs for insulin?

(1)

	endocrine gland	target organs
<input type="checkbox"/> A	adrenal	liver and muscles
<input type="checkbox"/> B	adrenal	small and large intestines
<input type="checkbox"/> C	pancreas	liver and muscles
<input type="checkbox"/> D	pancreas	small and large intestines

(ii) Which part of the blood transports insulin to its target organs?

(1)

- A plasma
- B red blood cells
- C white blood cells
- D platelets

Q3.

How is adrenalin transported from the adrenal glands to its target organs?

(1)

- A by transpiration
- B by osmosis
- C dissolved in blood plasma
- D carried by red blood cells

Q4.

Insulin is produced by an endocrine gland and is transported in the blood.

Explain how controlling the diet can be used to treat type 2 diabetes.

(2)

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Q5.

Figure 3 shows the positions of the endocrine glands in a woman and a man.

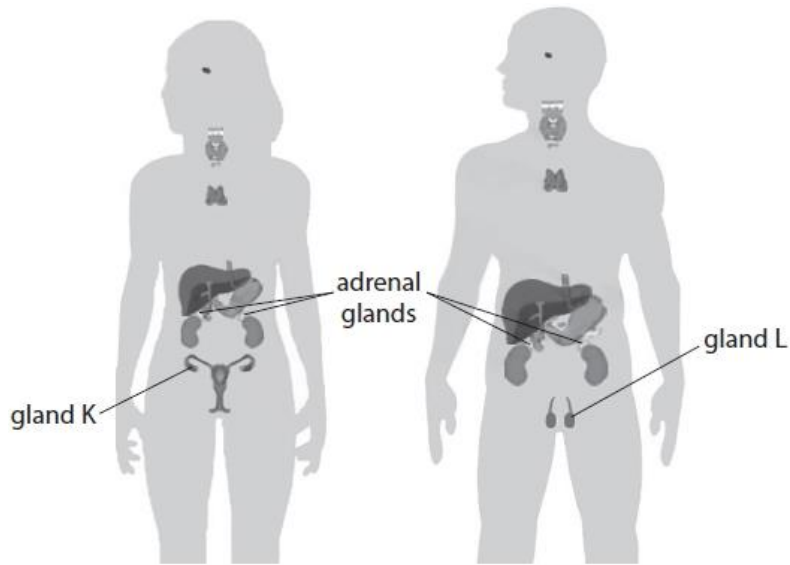


Figure 3

Draw **one** straight line from each hormone to the effect of the hormone on the body.

(2)

hormone	effect of hormone
hormone from gland K in the woman	increases glucose levels
hormone from gland L in the man	prepares the uterus lining for a fertilised egg
	causes facial hair to grow
	controls the water content of the body
	decreases sweating

Q6.

Figure 7 shows the percentage possibility of people with diabetes developing other health problems.

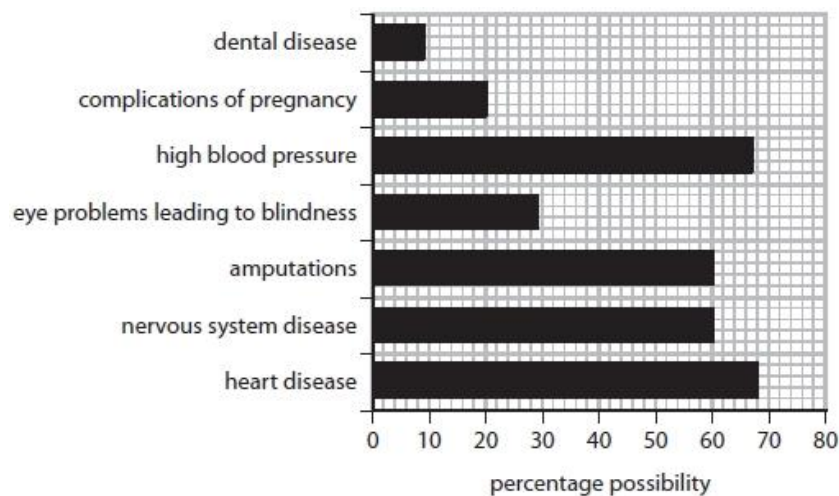


Figure 7

(i) Which health problem would a person with diabetes be most likely to develop?

(1)

- A dental disease
- B high blood pressure
- C heart disease
- D nervous system disease

(ii) High blood pressure damages capillaries.

Give a reason why capillaries are damaged by high blood pressure.

(1)

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Q7.

Figure 4 shows the concentration of glucose in the blood of a person.

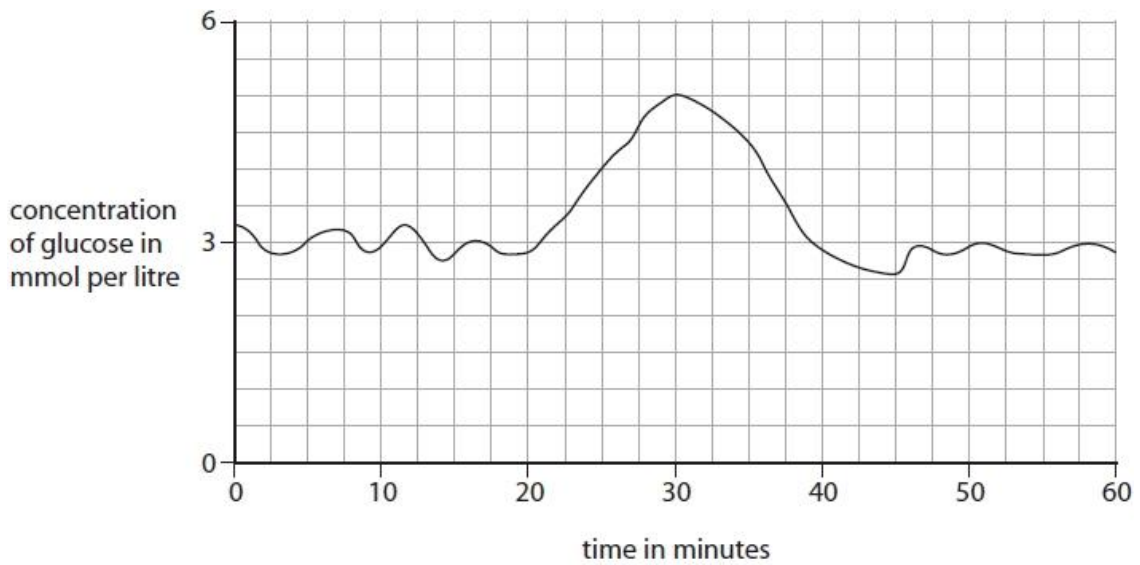


Figure 4

(i) Describe the trends shown in Figure 4 from 0 minutes to 30 minutes.

(2)

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(ii) Explain why the concentration of glucose decreases from 30 minutes to 40 minutes.

(2)

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Higher tier questions

Q8.

(i) A patient visits his doctor because he is putting on weight but does not think he is increasing his calorie intake.

The patient has a height of 1.9m and a body mass of 120kg.

What is his BMI?

- A 0.0083
- B 33.2
- C 0.016
- D 66.4

(1)

The doctor diagnosed this person with an underactive thyroid gland.

* (ii) Explain why an underactive thyroid could cause this patient to have an increased body mass.

(6)

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Q9.

The female population of Britain is 32.6 million.

The percentage of this population taking the combined contraceptive pill is 13.2%.

The combined pill is 98.8% effective.

Calculate the maximum number of females taking the combined contraceptive pill who could become pregnant.

(3)

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Q10.

Figure 5 shows the level of progesterone for a female during five different stages of the menstrual cycle.

days in the menstrual cycle	progesterone level (nmol/l)
1–9	1.85
10–14	1.48
15–17	14.28
18–23	35.27
24–28	17.11

Figure 5

(i) Describe the changes in progesterone levels during the 28-day cycle.

(2)

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(ii) Explain why progesterone levels changed following day 14.

(2)

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(iii) Use Figure 5 to explain if the female is pregnant.

(2)

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Q11.

Figure 17 shows the concentration of the hormones oestrogen and progesterone in the blood of women of different ages.

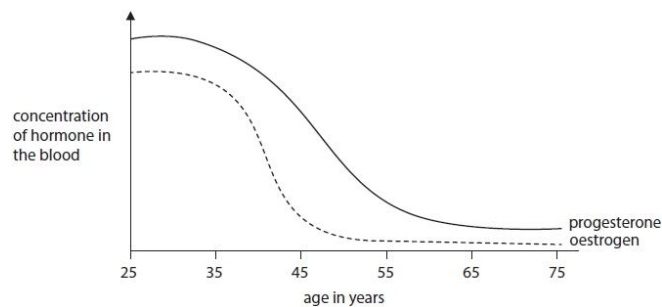


Figure 17

(i) Use information from Figure 17 to explain why women over the age of 50 are less likely to ovulate.

(2)

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(ii) Use information from Figure 17 to explain why women are less likely to menstruate after the age of 60.

(2)

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(iii) Explain how clomifene therapy may increase the chance of a woman over the age of 50 becoming pregnant.

(2)

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(iv) The hormone progesterone is produced by the

(1)

- A corpus luteum
- B pituitary
- C thyroid
- D uterus

Q12.

Hormones are also used as a method of contraception.

Explain why taking high levels of oestrogen and progesterone in the combined contraceptive pill reduces the chance of pregnancy.

(2)

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Mark Scheme

Q1.

Question number	Answer	Mark
	<p>D homeostasis (1)</p> <p>The only correct answer is D</p> <p><i>A is not correct because respiration is not the name given to the process of maintaining the internal body conditions.</i></p> <p><i>B is not correct because diffusion is not the name given to the process of maintaining the internal body conditions.</i></p> <p><i>C is not correct because digestion is not the name given to the process of maintaining the internal body conditions.</i></p>	<p>(1)</p> <p>AO1.1</p>

Q2.

Question number	Answer	Mark
(i)	<p>C pancreas liver and muscles</p> <p>1. The only correct answer is C</p> <p><i>A is not correct because the adrenal glands do not produce insulin</i></p> <p><i>B is not correct because the adrenal glands do not produce insulin and the small and large intestines are not the target organs for insulin</i></p> <p><i>D is not correct because the small and large intestines are not the target organs for insulin</i></p>	<p>(1)</p> <p>AO 1 1</p>

Question number	Answer	Mark
(ii)	<p>A plasma</p> <p>1. The only correct answer is A</p> <p><i>B is not correct because red blood cells do not transport insulin</i></p> <p><i>C is not correct because white blood cells do not transport insulin</i></p> <p><i>D is not correct because platelets do not transport insulin</i></p>	<p>(1)</p> <p>AO 1 1</p>

Q3.

Question number	Answer	Mark
	<p>C dissolved in blood plasma (1)</p> <p>The only correct answer is C</p> <p><i>A is not correct because adrenalin is not transported by transpiration.</i></p> <p><i>B is not correct because the adrenalin is not transported by osmosis</i></p> <p><i>D is not correct because the adrenalin is not transported by red blood cells</i></p>	<p>(1)</p> <p>AO1.1</p>

Q4.

Question number	Answer	Mark
	An explanation that includes the following: <ul style="list-style-type: none"> • reduce the levels of carbohydrate / sugars / glucose in the diet (1) • to ensure that blood glucose levels do not rise too high / too quickly / so that the insulin can cope. (1) OR <ul style="list-style-type: none"> • lose weight (1) • insulin resistance reduced / body will produce more insulin / cells respond to insulin (1) 	(2) AO 1 2

Q5.

Question number	Answer	Mark
	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>hormone</p> <div style="border: 1px solid black; padding: 2px; width: 80px; margin: 5px auto;">hormone from gland K</div> <div style="border: 1px solid black; padding: 2px; width: 80px; margin: 5px auto;">hormone from gland L</div> </div> <div style="text-align: center;"> <p>effect of hormone</p> <div style="border: 1px solid black; padding: 2px; width: 150px; margin: 5px auto;">increases glucose levels</div> <div style="border: 1px solid black; padding: 2px; width: 150px; margin: 5px auto;">prepares the uterus lining for a fertilised egg</div> <div style="border: 1px solid black; padding: 2px; width: 150px; margin: 5px auto;">causes facial hair to grow</div> <div style="border: 1px solid black; padding: 2px; width: 150px; margin: 5px auto;">controls the water content of the body</div> <div style="border: 1px solid black; padding: 2px; width: 150px; margin: 5px auto;">decreases sweating</div> </div> </div> <p>Do not award mark if two lines are drawn from hormone box K</p> <p>Do not award mark if two lines are drawn from hormone box L</p>	(2) CS 7.1 AO2.1

Q6.

Question number	Answer	Mark
(i)	C heart disease	(1)

Question number	Answer	Mark
(ii)	capillaries have thin / weak walls	(1)

Q7.

Question number	Answer	Mark
(i)	A description including two from: <ul style="list-style-type: none"> • fluctuates / stays roughly the same (1) • and then increases (1) • correct reference to data from the graph (1) 	(2) AO3 1a 1b

Question number	Answer	Additional guidance	Mark
(ii)	<p>An explanation including two from the following:</p> <ul style="list-style-type: none"> • (more) insulin (is released) (1) • which makes the {cells / tissues / liver / muscles} absorb glucose (1) • to be {stored as /changed into} glycogen (1) • (glucose is) used to supply energy / in respiration / during exercise (1) 	Reject create / make energy	(2) AO1 1 2.1

Q8.

Question number	Answer	Mark
(i)	B	(1)

Question Number	Indicative content	Mark
* (ii)	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p style="text-align: center;">AO1 (6 marks)</p> <ul style="list-style-type: none"> • the thyroid gland produces thyroxine • thyroxine helps to regulate metabolic rate • low levels of thyroxine should stimulate the production of TRH • TSH being produced and more thyroxine being released • an underactive thyroid would cause less thyroxine to be produced • metabolic rate to drop • less energy (calories) are available for tasks • more fat storage so the person gains body mass 	(6)

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	<ul style="list-style-type: none"> Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) Presents an explanation with some structure and coherence. (AO1)
Level 2	3–4	<ul style="list-style-type: none"> Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5–6	<ul style="list-style-type: none"> Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Q9.

Question number	Answer	Additional guidance	Mark
	$(32\,600\,000 \div 100) \times 13.2 / 4\,303\,200 / 4.3 \text{ million (1)}$ $(100 - 98.8) = 1.2 \text{ (1)}$ 51 638	accept 32.6 million \times 0.132 accept any correct rounding up to 4.3 million accept 0.012 (1) accept a calculation of 98.8% accept 51 600 for 3 marks accept 51 638.4 for 2 marks award full marks for correct answer without working accept alternative methods of calculation	(3) AO2 1

Q10.

Question number	Answer	Mark
(i)	An answer that combines points of interpretation/evaluation to provide a logical description: <ul style="list-style-type: none"> levels remain low up until day 14 then rise (1) they continue to rise to day 23 and drop at day 24 (1) 	(2)

Question number	Answer	Mark
(ii)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark): <ul style="list-style-type: none"> as ovulation occurs (1) the levels of progesterone released from the corpus luteum increases to maintain the lining of the uterus (1) 	(2)

Question number	Answer	Mark
(iii)	An explanation that combines identification via a judgment (1 mark) to reach a conclusion via justification/reasoning (1 mark): <ul style="list-style-type: none"> progesterone levels fall after day 23 to 17.11 (1) so uterus wall thickness is not maintained and therefore pregnancy has not occurred (1) 	(2)

Q11.

Question number	Answer	Mark
(i)	An explanation linking two of the following: <ul style="list-style-type: none"> women over the age of 50 have low levels of oestrogen (1) (high levels of) oestrogen are needed for LH to be released / levels of oestrogen are too low for LH to be released (1) (a surge of) LH is needed for ovulation to occur (1) 	(2) AO 3 1a AO 3 1b

Question number	Answer	Additional guidance	Mark
(ii)	An explanation linking: <ul style="list-style-type: none"> low levels of oestrogen (1) (low levels of oestrogen) stops the lining of the uterus building up / so no lining to be lost (1) 	reject progesterone	(2) AO3 2a AO3 2b

Question number	Answer	Additional guidance	Mark
(iii)	An explanation linking the following: <ul style="list-style-type: none"> causes the release of FSH (1) stimulating eggs to develop (in the follicles/ovary) (1) OR <ul style="list-style-type: none"> causes the release of LH (1) stimulating ovulation (1) 	accept stimulates follicles to mature	(2) AO 2 1

Question number	Answer	Mark
(iv)	A corpus luteum 1. The only correct answer is A <i>B is not correct because The pituitary gland releases the hormones LH and FSH not progesterone</i> <i>C is not correct because the thyroid gland releases TSH and thyroxine not progesterone</i> <i>D is not correct because the uterus does not release any hormones it is the site of the action of progesterone</i>	(1) AO 1 1

Q12.

Question number	Answer	Additional guidance	Mark
	An explanation linking: <ul style="list-style-type: none"> • to inhibit the production of FSH (1) • to prevent eggs maturing (1) OR <ul style="list-style-type: none"> • to inhibit the production LH (1) • so ovulation is prevented (1) 	accept thickens mucus (1) to prevent sperm reaching the egg/ entering the uterus (1) accept thins lining of the uterus (1) so less chance of implanting (1)	(2) AO1 1