Question number	Part	Step	Answer	Additional guidance	Marks
1	ai	2	thermometer		**1 mark**
	aii	3	Any **one** from: ● Wear goggles/safety spectacles. (1) ● Avoid contact with acid/wear gloves/wash off splashes. (1)	Do not accept just 'spectacles' or 'glasses' Ignore references to use of a water bath (given)	**1 mark**
	b	4	An explanation that includes: ● as a stain/to add colour or contrast (1) ● to make cells/cell structures easier to see/more visible (1)	Accept making a correctly named structure more visible: nucleus/ chromosomes/ genetic material	**2 marks**
	c	5	**B** × 40		**1 mark**
2	ai	6	Any **one** from: ● no nucleus (1) ● biconcave/large surface area (1)		**1 mark**
	aii	7	Substitution: 2.8 ÷ 400 Evaluation: = 0.007 (mm)	Allow full marks for correct final answer with no working	**2 marks**
	b	7	An explanation that includes any **two** from: ● larg(er) surface area (1) ● for uptake of minerals/water (1) ● correct reference to better anchorage/fit between soil particles (1)		**2 marks**
3	ai	2	**C** area 3		**1 mark**
	aii	7	Any **one** from: ● (controls) heart rate (1) ● (controls) breathing rate (1) ● (controls) reflexes or named reflex e.g. vomiting, sneezing, swallowing (1)	Do not credit just 'connects brain to spinal cord' without a *function* being given	**1 mark**

Question number	Part	Step	Answer	Additional guidance	Marks
	b	7–8	Provide a logical description up to a maximum of 3 marks: ● (This is a) reflex arc (which) is a nervous/neural pathway (that controls a reflex action). (1) ● (Impulses from) pain receptor in hand travel along sensory neurone (1) to CNS/spinal cord/relay neurone. (1) ● (Impulses from CNS) travel along motor neurone to effector/muscle (1) and muscle contracts (to move hand). (1)	Accept biceps instead of muscle, but not triceps as this would not withdraw hand	**3 marks**
4	a	5	**B** differentiation		**1 mark**
	b	7	(embryonic) stem cells		**1 mark**
	c	6	Any **one** from: ● Keep lid on./Do not open./Open with care. (1) ● Wash hands after handling/wear gloves/wear safety glasses/wear lab coat. (1)	A clear reference to preventing *contamination of contents* of Petri dish OR A clear reference to *harm to human* from any contamination from contents	**1 mark**
	d	8	An explanation that includes each of the following points: ● uncontrolled cell division/mitosis (of embryo cells) (1) ● lump of cells/mass of cells/ tumour forms (1)		**2 marks**
5	a	8	Any **one** from: ● length/height (1) ● (body) volume (1) ● head circumference (1)	Credit any other potentially valid measurement that would not have a negative impact on child, e.g. length of femur	**1 mark**
	bi	8	8 (kg)		**1 mark**
	bii	8	9 (%)		**1 mark**

Question number	Part	Step	Answer	Additional guidance	Marks
	biii	8	Substitution: $\frac{11.5-5}{5}\times 100$ or $\frac{6.5}{5}\times 100$ Evaluation: = 130 (%)	Allow full marks for correct final answer with no working	**2 marks**
	biv	8	A statement about the baby's mass: ● The baby's mass remains within 91st to 98th percentiles/between same curves (as where it started). (1) Followed by an explanation: ● The baby's growth is healthy/ growing well/growing as expected /growth has not fluctuated (very much). (1)	Accept references to 'normal' growth	**2 marks**
6	a	3	**C** cornea		**1 mark**
	b	5	sends impulses to the brain		**1 mark**
	c	7	An answer that combines the following points of understanding to provide a logical description: ● Circular muscles contract ● (making) pupil narrow/constricts pupil.		**2 marks**
	d	7–8	(1 in 12 men out of 45000 and 1 in 200 women out of 45000) Substitution (men): 45000/12 = 3750 (1) Substitution (women): 45000/200 = 225 (1) Evaluation: = 3975 (1)	Allow full marks for correct final answer with no working If final answer is incorrect, award one working mark for correct substitution and sub-total for men and a second working mark for correct substitution and sub-total for women	**3 marks**
	e	7–8	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. The indicative content below is not prescriptive, and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.		**6 marks**

Question number	Part	Step	Answer	Additional guidance	Marks
			Indicative content AO1 (6 marks) An explanation making use of the following points and key terms: **Causes and treatments:** **Cataracts:** ● Protein build-up ● causes cloudy lens. ● Lens replaced surgically with a plastic one. **Long-sightedness:** ● eyeball too short ● or insufficient curvature of cornea ● Image focused behind retina and ● corrected using converging lens. ● Lens bends rays before they reach the eye. ● contact lenses/spectacles ● laser surgery **Short-sightedness:** ● eyeball too long ● or cornea too curved ● Image focused in front of retina and ● corrected using diverging lens. ● Lens spreads out rays before they reach the eye. ● contact lenses/spectacles ● laser surgery		

Step	Marks	Descriptor
U	0	No awardable material.
3–4	1–2	**Level 1** ● 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)
5–6	3–4	**Level 2** ● 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)
7–8	5–6	**Level 3** ● 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)

Step boundaries

Step	Marks
U	0–1
1	2–4
2	5–8
3	9–10
4	11–13
5	14–15
6	16–17
7	18–21
8	22+

Indicative grade boundaries

Indicative grade	Marks
U	0–4
1	5–8
2	9–13
3	14–17
4	18–21
5	22+

Question number	Part	Step	Answer	Additional guidance	Marks
1	a	8	Any **one** from: ● length/height (1) ● (body) volume (1) ● head circumference (1)	Credit any other potentially valid measurement that would not have a negative impact on child, e.g. length of femur	**1 mark**
	bi	8	8 (kg)		**1 mark**
	bii	8	9 (%)		**1 mark**
	biii	8	Substitution: $\frac{11.5-5}{5}\times 100$ or $\frac{6.5}{5}\times 100$ Evaluation: = 130 (%)	Allow full marks for correct final answer with no working	**2 marks**
	biv	8	A statement about the baby's mass: ● The baby's mass remains within 91st to 98th percentiles/between same curves (as where it started). (1) Followed by an explanation: ● The baby's growth is healthy/growing well/growing as expected/growth has not fluctuated (very much). (1)	Accept references to 'normal' growth	**2 marks**
2	a	6	**B** differentiation		**1 mark**
	b	7	(embryonic) stem cells		**1 mark**
	c	6	Any **one** from: ● Keep lid on/do not open/open with care. (1) ● Wash hands after handling/wear gloves/wear safety glasses/wear lab coat. (1)	A clear reference to preventing *contamination of contents* of Petri dish OR A clear reference to *harm to human* from any contamination from contents	**1 mark**
	d	8	An explanation that includes each of the following points: ● uncontrolled cell division/mitosis (of embryo cells) (1) ● lump of cells/mass of cells/tumour forms (1)		**2 marks**

Question number	Part	Step	Answer	Additional guidance	Marks
3	ai	8	central nervous system		**1 mark**
	aii	8	brain OR spinal cord		**1 mark**
	bi	9	Substitution: $\frac{1800}{105}$ Evaluation: = 17.14	Full marks for correct final answer with no working	**2 marks**
	bii	9	Substitution: $\frac{1800}{3}$ Evaluation: = 600	Full marks for correct final answer with no working	**2 marks**
4	a	8	Any **two** linked pairs from: ● cut/injury from scalpel/mounted needle (1) ● take care with sharp tools/cut downwards/cut onto a surface/ensure quality of blade (1) OR ● injury from (ethanoic or hydrochloric) acid (1) ● wear goggles/safety spectacles/avoid contact with acid/wear gloves/wash off splashes (1) OR ● injury from (blue) stain (1) ● wear goggles/safety spectacles/avoid contact with stain/wear gloves/wash off splashes (1)	Accept wear gloves Accept use water bath to heat (hydrochloric) acid Ignore references to allergies and/or general lab safety references (do not run etc.) throughout	**4 marks**
	b	9	**A** (C) A E D B		**1 mark**

Question number	Part	Step	Answer	Additional guidance	Marks
5	ai	9	Any **one** of the following: ● Lens can no longer become convex enough/cannot refract light enough. (1) ● Rays do not focus on the retina. (1) ● Rays focus behind/beyond retina. (1)	Accept wide instead of convex Accept bend instead of refract	**1 mark**
	aii	9	An explanation that includes the following: ● Glasses would have converging lenses (1) ● so the eye's lens would not need to refract rays as much/the converging lenses would give additional refraction. (1)	Accept bend instead of refract	**2 marks**
	b	10	A statement about which part of the retina is best for colour vision: ● The centre/the part closest to 0° (is best). (1) Followed by an explanation: ● (It has the) highest concentration of cone cells/cones. (1)		**2 marks**
	c	11	An explanation that includes the following: ● Rod cells are used to detect dim light. (1) ● The highest concentrations of rod cells are either side of the centre (of the retina). (1)		**2 marks**
	d	9	**D** the blind spot is found between 14° and 19°		**1 mark**
6	ai	9	**C**		**1 mark**
	aii	11	An answer that includes the following: ● The cerebellum controls fine motor movements. (1) ● Increase in fine motor control is part of evolution/humans have developed finer motor control. (1)	Accept phrases such as manual dexterity or an example instead of fine motor control	**2 marks**
	b	12	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. The indicative content below is not prescriptive, and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **Indicative content AO1 (3 marks)** Recall details of what cancer is and how brain tumours can be treated: ● Cancer is a mass of rapidly dividing cells. ● Cell division is happening faster than it should be.		**6 marks**

Question number	Part	Step	Answer	Additional guidance	Marks
			● Cancer in the brain can be diagnosed using CT scans. ● Cancer in the brain can be diagnosed using PET scans. ● Brain tumours can be treated with radiotherapy. ● Brain tumours can be treated with chemotherapy. **Indicative content AO2 (3 marks)** Link the development of the tumour to difficulties in the brain and each technique to its advantages: ● A tumour could damage brain function/other cells. ● A tumour could also reduce blood flow to cells in the brain. ● Damage could lead to reduced brain function in some areas. ● The brain is difficult to access. ● This problem with access makes both treatment and diagnosis very difficult. ● Surgery on the brain is very risky/might cause damage in other areas. ● CT scans means that denser tissue/tumours can be seen and their position located easily/without surgery. ● PET scans show areas of brain activity and can be used to look at tumours and any damage. ● Radiotherapy uses targeted high energy X-rays to kill tumour cells. ● Chemotherapy uses chemicals to kill rapidly dividing cells. ● Role of blood-brain barrier and issues it may cause with chemotherapy.		

Step	Marks	Descriptor
U	0	No awardable content.
10	1–2	**Level 1** ● Demonstrates elements of biology understanding, some of which are inaccurate. Understanding of scientific ideas lacks detail. (AO1) ● Lines of reasoning are unsupported or unclear. (AO2)
11	3–4	**Level 2** ● Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) ● Lines of reasoning mostly supported through the application of relevant evidence. (AO2)
12	5–6	**Level 3** ● Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) ● Lines of reasoning are supported by sustained application of relevant evidence. (AO2)

Step boundaries

Step	Marks
U	0–7
5	8
6	9–10
7	11–14
8	15–18
9	19–22
10	23–26
11	27–31
12	32+

Indicative grade boundaries

Indicative grade	Marks
U	0–7
3	8–10
4	11–14
5	15–18
6	19–22
7	23–26
8	27–31
9	32+