PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

BIOLOGY



MARK SCHEME

TOPIC 2: CELLS AND CONTROL (PAPER 1, PACK 1)

SCORE	PERCENTAGE
/76	%

STEMUP

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Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
(i)	Any **one** from: • pig kidneys cannot be used in humans (1) • pig kidneys would be rejected (by humans) (1) • to prevent competition between the pig and the human organ (1) • so the human kidneys form properly (1)	 ignore so it grows human kidneys accept so there is room for the human kidneys	**(1)** **AO2 1**

Question number	Answer	Mark
(ii)	An explanation linking **two** from: • stem cells {are undifferentiated / are unspecialised / can differentiate / become specialised / form any type of cell} (1) • so can produce the {kidney / kidney cells / kidney tissue} (1) • that won't be rejected (when transplanted) (1)	**(2)** **AO1 1**

Q2.

Question number	Answer	Additional Guidance	Mark
(i)	$2.0 \times 10^8 - 1.6 \times 10^7$ / 200 000 000 – 16 000 000 /184 000 000 (1) 1.84×10^8 / 1.8×10^8	award full marks for correct answer **accept** 18.4×10^7 **or** 18×10^7 **for 1 mark**	**(2)** AO2(1)

Question number	Answer	Additional guidance	Mark
(ii)	An explanation linking: • (myelination) speeds up impulses (1) • insulates the {axon/neurone} (1) • motor neurones transmit information from the CNS / motor neurones transmit information to effectors / neurones in the brain connect to other neurones in the brain (1) • (motor neurones) transmit information over a greater distance (than neurones in the brain) (1)	accept signals/messages for impulses accept brain/spinal cord/relay neurone for CNS accept muscles/ glands for effectors accept idea that motor neurones can be part of a reflex so need quick impulses (1)	**(3)** AO2(1)

Q3.

Question number	Answer	Additional guidance	Mark
(i)	0.035 ÷ 5 = 0.007 (1) 7 / -7 (ms)	award two marks for correct answer with no working accept 0.033 ÷ 4 =0.008 for 1 mark if working shown accept 8 / -8 (ms) for 2 marks if working shown. allow ecf for incorrect mean converted into ms for 1 mark	**(2)** **AO2 1**

Question number	Answer	Additional guidance	Mark
(ii)	Any two from: • test the drink on more people / different people (1) • more repeats on the same people (1) • repeat using different volumes of the drink (1) • repeat using different times between drinking and the test (1) • repeat the experiment with just water (1) • control other environmental factors/named factors (1)	 accept different amounts accept use a control/use a placebo accept tiredness/health/drug intake/food intake	**(2)** **AO3 3b**

Q4.

Question Number	Answer	Additional Guidance	Mark
(i)	(8 x 4) = 32 (grams of alcohol) (1) 1.2 / 1.20 (x risk)	award full marks for the correct answer with no workings	**(2)** **AO3**

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer including two from: • mutations in DNA (1) • cell division is uncontrolled (1) • leading to the formation of a tumour / growth / mass of cells (1)	 accept change in the gene/cell mutates accept {rapid / continuous} cell division	**(2)** **AO2 1**

Q5.

Question number	Answer	Additional Guidance	Mark
	Any three from: • mitosis produces 2 cells and meiosis produces 4 cells (1) • mitosis produces **genetically** identical cells and meiosis produces **genetically** different cells (1) • mitosis produces diploid cells and meiosis produces haploid cells (1) • mitosis produces body cells and meiosis produces {gametes /sex cells} (1)	 accept offspring for cells mitosis is involved in asexual reproduction and meiosis is involved in sexual reproduction (1)	**(3)** AO1 1

Q6.

Question Number	Answer	Additional guidance	Mark
(i)	A description including **three** from: • the impulse (in the relay neurone) triggers the release of a chemical (1) • neurotransmitter (1) • (neurotransmitter) **diffuses** (1) • across the synapse (1) • new impulse triggered in {motor neurone / next neurone} (1)	accept chemical messenger accept across the gap	**(3)** **AO1 1**

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation linking **two** from: • a process that occurs in response to danger (1) • which bypasses the {brain / parts of the brain} / is an {involuntary process / subconscious process} (1) • so there is a faster transmission (of electrical impulses) / faster response / allows a quick reaction (1) • to protect the body from harm (1)	accept goes to the spinal cord accept react without thinking accept examples of actions to protect the body e.g. pulling hand away	**(2)** **AO1 1**

Q7.

Question number	Answer	Additional guidance	Mark
(i)	Two from: • (meristem cells) are undifferentiated • (meristem cells) divide / produce more cells (1) • by mitosis (1)	accept are stem cells accept (the cells produced) can differentiate /become specialised/elongate (1)	(2) AO1 1

Question number	Answer	Additional guidance	Mark
(ii)	An answer including: • use a thin section of {cells/meristem} (1) • add a stain / named stain (1) • place a cover slip on top of the sample (1)	accept add a sample of the cells to the microscope slide accept a description of a coverslip	(3) AO1 2

Q8.

Question Number	Answer	Additional guidance	Mark
	Any three from: • have the potential to produce any cell type (1) • no need to use embryonic stem cells (1) • less chance of patient rejecting their own cells (1) • used to treat conditions which are currently incurable / used for **cell** transplants /used to replace faulty cells (1)	 accept can turn into **many** cell types /pluripotent /totipotent accept embryos do not need to be killed accept named conditions e.g Parkinson's / diabetes ignore references to cloning body parts / replace organs / treat cancer unless qualified	**(3)** AO 2 1

Q9.

Question number	Answer	Additional guidance	Mark
	A description including **three** from: • two cells (1) • diploid cells / same number of chromosomes as parent cell (1) • **genetically** identical cells (1) • body cells (1)	 accept 23 pairs of chromosomes / 46 chromosomes accept **cells** for growth / repair	**(3)** **AO1 1**

Q10.

Question number	Answer	Mark
	An answer that combines points of interpretation and evaluation to provide a logical description: • the chromosomes are split (1) • then the chromatids are pulled to either side of the cell (1) • by spindle fibres (1)	**(3)**

Q11.

Question Number	Answer	Additional Guidance	Mark
	An answer including **four** from: Benefits (maximum 2 marks): • stem cells can differentiate / become specialised (1) • replace (damage) cells (1) • reduce symptoms of arthritis (1) Risks (maximum 2 marks): • new cells do not function correctly (1) • stem cells continue to divide (1) • risk of side effects / symptoms worsen / rejecting cells (1)	accept can become {joint cells / any type of cell} accept repair damaged joints accept cell division could develop into cancer accept may have to take medication to prevent rejection / suppress immune system	**(4)** **AO2 1**

Q12.

Question number	Indicative content	Mark
	AO2 (6 marks) **Synapse transmission** • neurones transmit electrical impulses • the synapse is a gap between 2 neurones • triggering the release of neurotransmitters • which diffuse across the synapse • as a chemical signal • neurotransmitters bind to receptors on the next neurone • triggering an electrical impulse in the next neurone **Painkillers** • prevent neurotransmitters binding to receptors in the next neurone • electrical impulse is not triggered • signal is not received by the central nervous system • person does not feel pain	**(6)**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. • Lines of reasoning are unsupported or unclear
Level 2	3–4	• The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question • Line of reasoning mostly supported through the application of relevant evidence
Level 3	5–6	• The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question • Line of reasoning are supported by sustained application of relevant evidence

Level	Mark	Descriptor
Level 1	1-2	A simple explanation of how messages are transmitted either over the synapse or along the neurone Linked to the effect of painkillers
Level 2	3-4	At least one link between how messages are transmitted between the neurone and the synapse or across the synapse Linked to the effect of painkillers
Level 3	5-6	A detailed description of how messages are passed across the synapse Linked to the effect of painkillers binding to receptors

Level	Mark	Examples of possible responses
	0	• No rewardable material.
Level 1	1 2	• Messages are passed along neurones as electrical impulses • A synapse is a gap between neurones and the painkillers prevent the pain message getting through to the brain
Level 2	3 4	• Synapses are gaps between neurones. Neurotransmitters diffuse across the gap to the next neurone. • Synapses are gaps between neurones. Neurotransmitters diffuse across the gap to the next neurone. The painkillers bind to receptors stopping the message being passed on to the CNS so the person does not feel pain.
Level 3	5 6	• Synapses are gaps between neurones. The electrical impulse reaches the synapse and causes neurotransmitters to diffuse across the gap to the next neurone. A new impulse is initiated in the next neurone. • Synapses are gaps between neurones. The electrical impulse reaches the synapse and causes neurotransmitters to diffuse across the gap to the next neurone. A new impulse is initiated in the next neurone. The painkillers prevent the neurotransmitters binding to the next neurone, so a new impulse is not generated and the message is not passed to the CNS.

Q13.

Question number	Answer	Additional guidance	Mark
	An explanation linking the following: • synapse is a gap between neurones (1) • (electrical) impulse stimulates the release of chemical (1) • neurotransmitter (1) • (chemical/neurotransmitter) **diffuses** across the {gap/synapse} (1) • **stimulates** an (electrical) impulse in the **next neurone** (1)	accept by neurotransmission (1)	**(4)** AO1(1)

Q14.

Question number	Answer	Additional guidance	Mark
	An explanation linking four of the following: • people do not finish their course (of Colistin) (1) • natural selection /evolution (occurs) (1) • some bacteria have a mutation/ (genetic) variation (1) • (these) resistant bacteria survive /resistant bacteria reproduce (1)	accept overuse / repeated exposure (to the antibiotic) accept they have evolved accept some bacteria have a {**gene/allele**} for resistance accept the non-resistant bacteria die / the fittest bacteria survive ignore immune bacteria	**(4)** AO2 1

Q15.

Question Number	Answer	Acceptable answers	Mark
(a)	**B** Two cells that are genetically identical		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(i)	A description to include 2 of the following points: select a species that glows (when UV light is shone on it) (1) identify the gene location (1) cut the gene out (1) . using a (restriction) enzyme (1)		**(2)**

Question Number		Indicative Content	Mark
QWC	***(b)(ii)**	a description to include some of the following: • diploid nucleus is removed from the genetically engineered cell • making a lone nucleus • a donor egg is enucleated/its nucleus is removed • the diploid nucleus from the GE cell is inserted into the enucleated egg cell • division of the nucleus is stimulated • by electric shock/chemicals • cell divides by mitosis • cells put into surrogate mother • cells divide further and differentiates to form an embryo • Tegon born and is a glow in the dark beagle The above points could be made diagrammatically, but a written description is also required.	**(6)**

Level	**0**	No rewardable content
1	**1 - 2**	• a limited description including at least one stage of cloning in an appropriate context • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	**3 - 4**	• a simple description of at least two stages of cloning linked sequentially in an appropriate context • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• a detailed explanation of most of the stages of cloning • answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Q16.

	Answer	Acceptable answers	Mark
(a)(i)	• height / growth increases until 15/18 (years old) (1) • height / growth starts to level off / plateau / slows down after 15/18 (1)	Accept increases and then levels off / height increases (until 20) for 1 mark ecf on figures quoted Accept growth stops after 18	**(2)**
(a)(ii)	• 155 / 155.5 – 132 / 132.5 (cm) (1) • answer between 22 and 23.5 (cm) (1)	Two marks for correct bald answer ecf 2 marks cannot be awarded if mp 1 not correct	**(2)**
(a)(iii)	An explanation linking two points • 95% will be smaller / that height or smaller OR 5% will be taller / at that height or taller (1) • at that age (1)		**(2)**
(b)(i)	transcription (1)	Accept phonetic spelling	**(1)**
(b)(ii)	A		**(1)**

Q17.

Question Number	Answer	Mark
(i)	A metaphase anaphase **The only correct answer is A** ***B*** *is not correct because cell Q is not telophase* ***C*** *is not correct because cell R is not interphase* ***D*** *is not correct because cell R is not interphase*	**(1)** **AO2 1**

Question Number	Answer	Additional Guidance	Mark
(ii)	A description including **two** from: • chromatids condense (1) • identical chromatids are joined (1) • nuclear membrane breaks down (1)	accept chromosomes condense / coil up / become visible accept chromosomes join accept nucleus breaks down accept spindle fibres form (1)	**(2)** **AO1 1**

Question Number	Answer	Mark
(iii)	cytokinesis	**(1)** **AO1 1**

Question Number	Answer	Mark
(iv)	B 75 µm **The only correct answer is B** ***A*** *is not correct because 0.75 µm is 0.00075 mm* ***C*** *is not correct because 750 µm is 0.75mm* ***D*** *is not correct because 75 000 µm is 75 mm*	**(1)** **AO1 1**

Q18.

Question Number	Answer	Mark
(i)	C 215 milliseconds **The only correct answer is C** ***A*** *is not correct because the median is not 200 milliseconds* ***B*** *is not correct because the median is not 210 milliseconds* ***D*** *is not correct because the median is not 225 milliseconds*	**(1)** **AO2 1**

Question Number	Answer	Additional Guidance	Mark
(ii)	A description including **three** from: • measure their reaction time using red squares (1) • keep everything else the same (as using blue squares) (1) • repeat measurements (for each student) (1) • calculate a mean reaction time (1) • control other variables (1)	accept see how fast they react with red squares accept examples of other variables e.g. tiredness / environment / health	**(3)** **AO3 3a**

Q19.

Question Number	Answer	Mark
(i)	B $R \rightarrow Q \rightarrow S \rightarrow P$ **1. The only correct answer is B** ***A*** *is not correct because Q is after R* ***C*** *is not correct because S is after Q* ***D*** *is not correct because R is before Q and S*	**(1)** AO 3 1b

Question Number	Answer	Mark
(ii)	A anaphase **1. The only correct answer is A** ***B*** *is not correct because R is prophase* ***C*** *is not correct because P is telophase* ***D*** *is not correct because Q is metaphase*	**(1)** AO 3 1a

Question Number	Answer	Additional guidance	Mark
(iii)	Any two from: • DNA is replicated (1) • production of cell {components /proteins / organelles}(1) • {metabolic activities / cell reactions} occur / **cell** growth(1)	 accept DNA duplicates /chromosomes duplicate accept sub-cellular structures / named structures chromosomes coil up / condense (1)	**(2)** AO 1 1

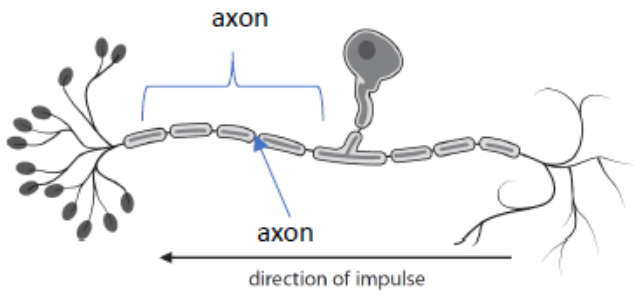
Q20.

Question number	Answer	Mark
	D	**(1)**

Q21.

Question number	Answer	Mark
	interphase	(1)

Q22.

Question number	Answer	Mark
(i)	 accept label line to any part of axon as indicated ignore lines to the myelin sheath	(1) AO1(1)

Question number	Answer	Additional Guidance	Mark
(ii)	An answer including: • transmit **electrical** impulses (1) • from {receptors / sense organ / named sense organ} to the {CNS /brain / spinal cord / relay neurone} (1)	 accept signals/ messages for impulses accept named receptors ignore detect stimuli	(2) AO1(1)

Q23.

	Answer	Acceptable answers	Mark
(i)	A description including **three** of the following points: • cell divides / cell division / cell splits(1) • two cells produced (1) • (both) diploid (1) • (both) cells are genetically identical (1)	credit correct reference to stages of mitosis: DNA replication / chromosomes duplicate (1) Chromosomes line up along the equator / middle of the cell (1) chromosomes pulled to either end of cell (1) cytokinesis / cytoplasm splits (1)	**(3)**
(ii)	A description including three of the following points: • ref (to many) cell divisions / eq (1) • growth (1) • ref to differentiation / specialisation (1) • ref to stem cells (1)	accept: gets bigger / larger accept: become specific cells	**(3)**

Q24.

	Answer	Acceptable answers	Mark
(i)	A – nucleus (1) B – myelin (sheath) (1) C – axon (1)	A – cell body B – Schwann cell / fatty layer	**(3)**

(ii)	C - effectors		**(1)**

Q25.

Question number	Answer	Additional guidance	Mark
(i)	sensory (neurone)	accept phonetically correct misspellings	**(1)** **AO1 1**

Question number	Answer	Mark
(ii)	B cell body dendron **The only correct answer is B** ***A** is not correct because P is the cell body* ***C** is not correct because P is the cell body* ***D** is not correct because Q is the dendron*	**(1)** **AO1 1**

Q26.

	Answer	Acceptable answers	Mark
a(i)	A – nucleus (1) B – myelin (sheath) (1) C – axon (1)	A – cell body B – Schwann cell / fatty layer	**(3)**
a(ii)	C - effectors		**(1)**
b(i)	(67 + 60+ 62) = 189 (1) (189) / 3 ans = 63 (ms) (1)	Two marks for correct bald answer ECF for incorrect calculation carried out correctly.	**(2)**
b(ii)	An explanation to include the following points: alcohol is a depressant (1) slows down the activity of the brain	**Reject**stimulant (no further marks awarded) **Ignore**references to CNS accept sedative	

	(1) (slows down) neurotransmission (1) (slows down) transmission at the synapse (1)	accept: slows reactions / reactions take longer / reaction time increases	**(2)**

Total for question = 8 marks

Q27.

	Answer	**Acceptable answers**	**Mark**
(i)	• height / growth increases until 15/18 (years old) (1) • height / growth starts to level off / plateau / slows down after 15/18 (1)	Accept increases and then levels off / height increases (until 20) for 1 mark ecf on figures quoted Accept growth stops after 18	**(2)**
(ii)	• 155 / 155.5 – 132 / 132.5 (cm) (1) • answer between 22 and 23.5 (cm) (1)	Two marks for correct bald answer ecf 2 marks cannot be awarded if mp 1 not correct	**(2)**
(iii)	An explanation linking two points • 95% will be smaller / that height or smaller OR 5% will be taller / at that height or taller (1) • at that age (1)		**(2)**

Q28.

Question Number	Answer	Acceptable answers	Mark
	A description linking four of the following {receptor} detects a stimulus (1) sensory neurone passes (impulse)to {relay neurone / spinal cord / CNS} (1) relay neurone in spinal cord /CNS (1) relay neurone passes (impulse) onto motor neurone (1) motor neurone passes (impulse) to {effector / muscle /gland} (1) {effector / muscle /gland} initiates response (1)	accept sensory neurone to motor neurone for 1 mark	**(4)**