

Question	Answers	Marks	Guidance
7			
(a)	29	1	
(b)	you also need to know the sequence/order [of bases]	1	triplets implies order ignore "to determine genetic code" – STEM
(c)	<p>[Level 3] Shows a grasp of all the aspects by discussing switching of genes, links protein to amino acids/ bases/ DNA / RNA, and appreciates that something in the cell carries a set of instructions, and appreciates that the protein is produced in a different part of the cell from the place where the information is stored. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Discusses amino acids/ bases/ DNA / RNA in an appropriate fashion, and appreciates that there is a code/instruction set and gives further detail. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Mentions amino acids/ bases/ DNA / RNA/ genes AND an extra aspect. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to A/A*</p> <p>indicative scientific points may include:</p> <p>Nucleus</p> <ul style="list-style-type: none"> • information stored in nucleus within the DNA • sequence of bases / code for order of amino acids • base sequence in nucleus is copied <p>Transport of information</p> <ul style="list-style-type: none"> • copied information goes to cytoplasm using mRNA <p>Construction of protein</p> <ul style="list-style-type: none"> • where protein is assembled • different proteins are made from different sequences of amino acids <p>Switching</p> <ul style="list-style-type: none"> • muscle and nerve cells have same genes • but specialised cells have only some genes switched on • nerve cells do not have gene for myosin switched on • muscle cells do have gene for myosin switched on <p>NB candidates not expected to know details of transcription or translation</p> <p>Use the L1, L2, L3 annotations in Scorris; do not use ticks.</p>

Question	Answers	Marks	Guidance
(d)	any three from: test more/ other people (1) test females (1) test older people (1) test people with weaker muscles (1)	3	one mark for each correct suggestion ignore incorrect suggestions credit any suitable suggestion by the candidate ignore statements which are too general eg 'different lifestyles' ignore "do the experiment again" ignore peer review/ get other scientists to test it [this answer not specific to investigation]
	Total	11	

Question	Answers	Marks	Guidance								
8 (a)	any two correct lines from: <table border="1"> <tr> <td>4 cell stage identical</td> <td>32 cell stage non-identical</td> </tr> <tr> <td>unspecialised</td> <td>specialised</td> </tr> <tr> <td>all genes switched on</td> <td>some switched off</td> </tr> <tr> <td>can develop into all types of cell</td> <td>cannot develop into all types of cell</td> </tr> </table>	4 cell stage identical	32 cell stage non-identical	unspecialised	specialised	all genes switched on	some switched off	can develop into all types of cell	cannot develop into all types of cell	1	ignore nomenclature differences eg zygote/embryo as the stem states that these are both stages of embryo
4 cell stage identical	32 cell stage non-identical										
unspecialised	specialised										
all genes switched on	some switched off										
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(b)	46	1									
(c)	Liza	1									
	Total	3									

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6 (a)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;">are produced by mitosis.</td> <td style="width: 20%; text-align: center;">✓</td> </tr> <tr> <td>can switch off any gene during development of the embryo.</td> <td style="text-align: center;">✓</td> </tr> <tr> <td>contain different genes to those found in the specialised cells.</td> <td></td> </tr> <tr> <td>contain half the number of chromosomes found in the zygote.</td> <td></td> </tr> </table>	are produced by mitosis.	✓	can switch off any gene during development of the embryo.	✓	contain different genes to those found in the specialised cells.		contain half the number of chromosomes found in the zygote.		2	<p>accept any clear indication of a correct response eg crosses if no ticks shown or shaded boxes</p> <p>if more than 2 responses – deduct 1 mark for each additional response</p>				
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(b)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;">The patient will contain DNA from another person.</td> <td style="width: 20%; text-align: center;">✓</td> </tr> <tr> <td>Embryonic stem cells may be larger than the patient's cells.</td> <td></td> </tr> <tr> <td>Donated embryonic stem cells may be rejected by the patient's body.</td> <td></td> </tr> <tr> <td>Embryos may be destroyed to collect the embryonic stem cells.</td> <td style="text-align: center;">✓</td> </tr> <tr> <td>Scientists and doctors must decide who receives the embryonic stem cells.</td> <td style="text-align: center;">✓</td> </tr> <tr> <td>The donated embryonic stem cells may not survive in the body of the patient.</td> <td></td> </tr> </table>	The patient will contain DNA from another person.	✓	Embryonic stem cells may be larger than the patient's cells.		Donated embryonic stem cells may be rejected by the patient's body.		Embryos may be destroyed to collect the embryonic stem cells.	✓	Scientists and doctors must decide who receives the embryonic stem cells.	✓	The donated embryonic stem cells may not survive in the body of the patient.		2	<p>3 correct responses = 2 marks 2 correct responses = 1 mark 1 correct responses = 0 marks</p> <p>accept any clear indication of a correct response eg crosses if no ticks shown or shaded boxes</p> <p>if more than 3 responses – deduct 1 mark for each additional response</p>
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(c)	<table border="1"> <thead> <tr> <th>DNA feature</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>number of strands</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>number of different types of bases</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>arrangement of bases between the strands</td> <td>fours</td> <td>pairs</td> <td>single</td> <td>triplets</td> </tr> <tr> <td>shape of molecule</td> <td>circular</td> <td>cube</td> <td>helix</td> <td>sheet</td> </tr> </tbody> </table>					DNA feature	1	2	3	4	number of strands	1	2	3	4	number of different types of bases	2	3	4	5	arrangement of bases between the strands	fours	pairs	single	triplets	shape of molecule	circular	cube	helix	sheet	1	<p>must show all 4 correct responses = 1 mark</p> <p>if more than 4 responses = 0 marks</p>
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3 (a)	1, 5, (2), 15, 11	2	4 correct responses = 2 marks 3 correct responses = 1 mark 2 or fewer correct responses = 0 marks
(b) (i)	36% (1) C pairs with G / if G is 36%, C must be the same (1)	2	allow bonds/joins/goes together/matches
(ii)	different genes code for/make different proteins / this (second) gene codes for a different protein/AW (2)	2	allow genes code for/make proteins = 1 mark
(c)	messenger RNA/mRNA (1)	1	allow upper or lower case letters
(d)	base sequence/triplet code changes so different <u>amino acids</u> are coded for (1) different sequence of amino acids means a different protein is made (1)	2	do not allow the idea that amino acids are 'made' allow frameshift mutation / 'it would have been 1 and 5 and is now 9 and 7' / 'code is now ATC TGC' as long as it is clear that this will lead to different <u>amino acids</u>

Question	Answer	Marks	Guidance									
10 (a)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 2px;">T</td> <td style="padding: 2px;">T</td> <td style="padding: 2px;">G</td> <td style="padding: 2px;">C</td> <td style="padding: 2px;">T</td> <td style="padding: 2px;">A</td> <td style="padding: 2px;">A</td> <td style="padding: 2px;">G</td> <td style="padding: 2px;">C</td> </tr> </table>	T	T	G	C	T	A	A	G	C	1	T goes with A and vice versa G goes with C and vice versa any mistake [0]
T	T	G	C	T	A	A	G	C				
(b)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; height: 20px;"></td> <td style="width: 50%;"></td> </tr> <tr> <td style="height: 20px;">The sequences of bases in the genes for actin...</td> <td style="text-align: center;">✓</td> </tr> <tr> <td style="height: 20px;">A cell can combine amino acids...</td> <td style="text-align: center;">✓</td> </tr> <tr> <td style="height: 20px;"></td> <td></td> </tr> </table>			The sequences of bases in the genes for actin...	✓	A cell can combine amino acids...	✓			2		
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(c) (i)	200	1										
(ii)	Dr Baker wants to study a fatal condition (1) Dr Smith wants to study a condition that affects most people (1)	2	ignore common									
	Total	6										

Question	Answer	Marks	Guidance												
12 (a) (i)	0.02 read from graph (1) 0.02 x 200 =4 (1)	2	correct answer with no working for [2] no ecf for incorrect reading from graph												
(ii)	1.2 mm	1	accept correct answer without units												
(b)	Chromosomes are: <ul style="list-style-type: none"> • copied during cell growth • separated in mitosis 	1	need both points to earn mark accept chromosomes shared between new cells in mitosis for separated in mitosis												
(c)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; height: 20px;"></td> <td style="width: 50%;"></td> </tr> <tr> <td style="height: 20px;">More auxin moves to the shaded side of the shoot.</td> <td style="text-align: center;">✓</td> </tr> <tr> <td style="height: 20px;">The side of the shoot with most auxin grows more.</td> <td style="text-align: center;">✓</td> </tr> <tr> <td style="height: 20px;"></td> <td></td> </tr> <tr> <td style="height: 20px;"></td> <td></td> </tr> <tr> <td style="height: 20px;"></td> <td></td> </tr> </table>			More auxin moves to the shaded side of the shoot.	✓	The side of the shoot with most auxin grows more.	✓							2	
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Question	Answer	Marks	Additional Guidance
3	<p>Level 3 (5-6 marks) Correct identification of the two stages where cell division occurs, AND comparison of the two types of cell division to include both similarities AND differences Quality of written communication does not impede communication of the science at this level</p> <p>Level 2 (3-4 marks) Correct identification of the two stages where cell division occurs AND identifies characteristics of the two types of cell division Quality of written communication partly impedes communication of the science at this level</p> <p>Level 1 (1-2marks) Correct identification of the stages where cell division occurs. Quality of written communication impedes communication of the science at this level</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit</p>	6	<p>This question is targeted at grades up to A</p> <p>Indicative scientific points may include</p> <p>Correct identification of the cell division at stages in the frogs life cycle:</p> <ul style="list-style-type: none"> • Stage A – meiosis • Stage C – mitosis <p>If Stage B is identified as meiosis or mitosis, alongside A or C, then do not credit A or C (as appropriate).</p> <p>Comparison of two forms of cell division:</p> <p>Similarities</p> <ul style="list-style-type: none"> • idea that both require DNA replication • idea that both require doubling / copying / duplication of chromosomes • cells in both will require a growth phase • during growth phase, more organelles will be produced

Question	Answer	Marks	Additional Guidance												
			<p>Differences</p> <table border="1"> <tr> <td><i>Mitosis</i></td> <td><i>Meiosis</i></td> </tr> <tr> <td>One division</td> <td>Two divisions</td> </tr> <tr> <td>Idea of 2 daughter cells</td> <td>Idea of 4 daughter cells</td> </tr> <tr> <td>Idea that daughter cells genetically identical</td> <td>Idea that daughter cells non-identical</td> </tr> <tr> <td>Idea that daughter cells are diploid/2n / same number of chromosomes as adult / same amount of DNA as adult</td> <td>Idea that daughter cells are haploid/n / half number of chromosomes as adult / half amount of DNA as adult</td> </tr> <tr> <td>Produces somatic/body cells</td> <td>Produces gametes</td> </tr> </table> <p>ignore mention of locations in which mitosis and meiosis take place</p>	<i>Mitosis</i>	<i>Meiosis</i>	One division	Two divisions	Idea of 2 daughter cells	Idea of 4 daughter cells	Idea that daughter cells genetically identical	Idea that daughter cells non-identical	Idea that daughter cells are diploid/2n / same number of chromosomes as adult / same amount of DNA as adult	Idea that daughter cells are haploid/n / half number of chromosomes as adult / half amount of DNA as adult	Produces somatic/body cells	Produces gametes
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Total		6													

Question	Answer	er	Marks	Guidance					
4 (a)	(i)	A meiosis B mitosis C mitosis	1	all correct responses needed for 1 mark reject meiosis/miosis					
	(ii)	any three from zygote contains chromosomes/gene/DNA/alleles from both parents ; zygote is split in 2/undergoes mitosis (to give 2 embryos/piglets) ; piglets have identical/same DNA/genes/alleles/are clones/same genotype ; embryos/piglets have different DNA/genes/chromosomes/alleles from parents	3	accept correct references to the letters/stages in the diagram accept piglets/embryos come from the same zygote ignore similar genes answers with correct descriptions of meiosis/mitosis but without reference to the diagram/scenario = 2 marks					
(b)	(i)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td>✓</td></tr> <tr><td>✓</td></tr> <tr><td> </td></tr> </table>			✓	✓		2	accept any clear response eg. crosses (without ticks), shaded boxes three ticks = 1 mark max. four or more ticks = 0 marks
✓									
✓									
	(ii)	any two from cells still unspecialised/undifferentiated/stem cells AND can become any type (of cell) ; any gene (at this stage) can be switched on/off ; before 8 cell stage	2	ignore 'not fully developed' accept genes are activated/inactivated					
	(iii)	any one from embryo may be destroyed/killed/harmed ; embryo does not have a choice	1	accept embryo could have grown to form a baby/person ignore playing God/it is immoral/not natural/cause a miscarriage					
		Total	9						

Question	Answer	Marks	Guidance
(e)	<p>(Level 3) Answer gives a good description of the processes taking place and attempts to explain how they are controlled by genes. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>(Level 2) Answer gives a description of the processes taking place, and includes some scientific details not shown on the diagram. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>(Level 1) Answer gives a simple description of the processes taking place, but only includes points shown on the diagram. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>(Level 0) Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to C</p> <p>Indicative scientific points at Level 1 include:</p> <p>process A:</p> <ul style="list-style-type: none"> • produces specialised cells • these cells can be used for tissue replacement <p>process B:</p> <ul style="list-style-type: none"> • produces unspecialised cells • these form a new cell culture <p>Indicative scientific points at Level 2 include:</p> <ul style="list-style-type: none"> • embryonic stem cells can be used to produce any other type of cell • differentiation • cells are replicating / dividing / mitosis • identical copies / cloning • example of tissue replacement • examples of a specialised cell <p>Indicative scientific points at Level 3 include:</p> <ul style="list-style-type: none"> • stem cells remain unspecialised until 8-cell stage • embryonic stem cells have the potential to switch on / off genes • switching on/off of specific genes leads to cell specialisation • genes that are switched on code for the proteins that the cell needs • different types of cell require different types of protein
	Total	15	

Question	Expected Answer	Marks	Additional Guidance
7 a	idea that colour / flower will be the same / ORA for seeds ; ref. to clone / genetically identical; ORA taking a cutting is a faster process / seeds would take longer to grow into a plant ;	3	Ignore cost
b	meristem	1	do not accept stem cell Ignore cambium
c	Tissue –phloem / xylem / palisade / spongy mesophyll / epidermis / cambium / meristem; Organ – flower/ root / leaf/ stem / fruit / petal / sepal / stamen / ovary ;	2	Accept higher level answers e.g. parenchyma
	Total	6	