PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



MARK SCHEME

TOPIC 2: CELLS, VIRUSES AND REPRODUCTION OF LIVING THINGS

EUKARYOTIC CELL CYCLE AND DIVISION

SCORE	PERCENTAGE
/45	%

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Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to three of the following: • because {meiosis / sexual reproduction / basidiospore production} results in {genetically different fungi / variation} (1) • because of {crossing over / random assortment / independent assortment} (1) • because of mutation (in the DNA) (1) • the {asexual cycle / production of uredospore} results in more stem rust fungus that plants are not resistant to (1)	ACCEPT recombinants ACCEPT only in the context of causing variation DO NOT ACCEPT meiosis causes mutation ACCEPT clones of stem rust fungus that plants are not resistant to	

Q2.

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)	An explanation that makes reference to the following points: • increase in number of cells by mitosis without growth (1) • therefore cells are progressively smaller (1) • cells form a thin layer surrounding a fluid-filled cavity (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(b)	• correct calculation (1)	Example of calculation ($\log_2 128 = 7$) Allow mark for correct answer with no working	**(1)**

Q3.

Question Number	Answer	Mark
(i)	**The only correct answer is C** ***A*** *is not correct because P is in prophase I and Q is in metaphase II* ***B*** *is not correct because P is in prophase I and Q is in metaphase II* ***D*** *is not correct because P is in prophase I and Q is in metaphase II*	**(1)**

Question Number	Answer	Mark
(ii)	**The only correct answer is B** ***A*** *is not correct because if non-disjunction occurred in meiosis I, it would generate one cell with four chromosomes (each composed of two chromatids) and one cell with two chromosomes (each composed of two chromatids). These cells would divide in meiosis II to generate two cells with four chromosomes and two cells with two chromosomes.* ***C*** *is not correct because if non-disjunction occurred in meiosis I, it would generate one cell with four chromosomes (each composed of two chromatids) and one cell with two chromosomes (each composed of two chromatids). These cells would divide in meiosis II to generate two cells with four chromosomes and two cells with two chromosomes.* ***D*** *is not correct because if non-disjunction occurred in meiosis I, it would generate one cell with four chromosomes (each composed of two chromatids) and one cell with two chromosomes (each composed of two chromatids). These cells would divide in meiosis II to generate two cells with four chromosomes and two cells with two chromosomes.*	**(1)**

Q4.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to the following: • number of pregnancies calculated (1) • number of babies calculated (1)	Correct answer gains full marks (500 000 ÷1000) x 14 = 7 000 (1.8 ÷ 100) x 7 000 = 126 or 14 x 500 = 7000 and then 7000 x 0.018 = 126	**(2)**

Q5.

Question Number	Correct Answer	Additional guidance	Mark
	An explanation that makes reference to three the following: • prophase absorbs twice as much light as cytokinesis because DNA/chromosome has replicated prior to prophase so twice as much DNA present (1) • as pairs of chromatids have separated in cytokinesis therefore DNA is reduced by half (1) • endosperm nucleus has 3 x DNA in pollen tube nucleus because a pollen tube nucleus {has only one set of chromosomes / haploid chromosome number} is produced by meiosis (1) • and the endosperm tissue has a triploid set of chromosomes (1)		**(3)**

Q6.

Question Number	Answer	Additional Guidance	Mark
(i)	B Female with Turner's syndrome *A is incorrect because the human has one X* *B is incorrect because the human is female* *C is incorrect because the human is female*		**1**
(ii)	A Non-disjunction producing a monosomy B is incorrect because it is a monosomy C is incorrect because it is due to non-disjunction C is incorrect because it is due to non-disjunction		**1**

Q7.

Question Number	Acceptable Answer	Additional guidance	Mark
	synthesis of ribosomes		**(1)**

Q8.

Question Number	Answer	Additional Guidance	Mark
(i)	C *Turner's syndrome due to monosomy* *A is incorrect because there are not three copies of chromosome number 21* *B is incorrect because there are not three copies of chromosome number 21* *D is incorrect because Turner's syndrome is a monosomy*		1

Question Number	Answer	Additional Guidance	Mark
(ii)	C non-disjunction *A because it is not a gene mutation* *B is incorrect because it is not a gene mutation* *D because there is a missing chromosome is incorrect*		1

Q9.

Question Number	Acceptable Answer	Additional guidance	Mark
(a)(i)	• length of cell = 20 (mm) (1) • conversion into µm = 20000 ÷ 23.5 (1) • magnification = 851 (1) • [ecf applies for mp 2 and 3]	Accept ± 1 mm Accept other appropriate calculation, e.g. measure in cm or converting 23.5 µm to mm or cm Correct answer gains full marks	**(3)**

Question Number	Acceptable Answer	Additional guidance	Mark
(a)(ii)	A description that makes reference to the following: • centromeres have separated (1) • spindle fibres have {shortened / contracted} (1) • chromatids pulled apart (1) • chromatids have moved to opposite poles (1)		**(4)**

Question Number	Acceptable Answer	Additional guidance	Mark
(b)(i)	C		**(1)**

Question Number	Acceptable Answer	Additional guidance	Mark
(b)(ii)	Because E is {in cytokinesis / in late telophase / dividing its cytoplasm} but G is still in {anaphase / mitosis} (1)		**(1)**

Q10.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to two of the following: • meiosis results in recombination of alleles (1) • due to {independent / random} assortment (of chromosomes) (1) • (and) due to crossing over between chromatids (between the same homologous chromosomes) (1)	**IGNORE** references to maternal and paternal chromosomes throughout **ACCEPT** description e.g. pairs of homologous chromosomes line up (on the equator) randomly **ACCEPT** description e.g. genetic material is swapped between chromatids (between the same homologous chromosomes) **DO NOT ACCEPT** wrong description/ wrong stage **IGNORE** mutations	(2) Exp

Q11.

Question Number	Answer	Additional Guidance	Mark
(i)	A ☒ **A** anaphase | telophase | prophase | metaphase *B is incorrect because X is not prophase* *C is incorrect because W is not prophase* *D is incorrect because W is not telophase*		**1**

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to four of the following: • colchicine has no effect on the percentage of cells in interphase (1) • colchicine arrests cells at prophase (1) • colchicine inhibits spindle (formation) (1) • fewer cells reach {metaphase / anaphase / telophase} with colchicine / more cells reach {metaphase / anaphase / telophase} without colchicine / more cells at prophase with colchicine /fewer cells at all phases except prophase (1) • correct reference to overlapping of standard deviations (1)	**Accept** colchicine stops (many) cells at prophase / cells can only reach prophase with colchicine **Accept** converse **Accept** converse	**4**

Q12.

Question Number	Answer	Additional Guidance	Mark
(i)	The only correct answer is **B** (diploid , triploid, haploid) **A** is not correct because the endosperm nucleus is not diploid but triploid **C** is not correct because the pollen tube nucleus is not diploid but haploid **D** is not correct because the zygote nucleus is not haploid but diploid and the pollen tube nucleus is not diploid but haploid		**(1)**

Question Number	Answer	Additional Guidance	Mark
(ii)	The only correct answer is **A** (meiosis, mitosis, mitosis) **B** is not correct because the third division is not meiosis but mitosis as the DNA mass remains the same **C** is not correct because the first division is not mitosis as the DNA mass halves and the second and third divisions are both mitosis as the DNA mass remains the same and does not halve **D** is not correct because the first nuclear division halves the DNA mass and the third nuclear division does not halve the DNA mass so is not meiosis		**(1)**

Q13.

Question Number	Answer	Additional Guidance	Mark
	• division (1) • multiplication (1)	3 ÷ 16 = 0.1875 0.1875 × 100 = 18.75 / 18.8 /19	**(2)**

Q14.

Question Number	Answer	Mark
(i)	**The only correct answer is A** ***B*** *is not correct because the father's mitochondria do not enter the ovum on fertilisation* ***C*** *is not correct because only the nucleus was used from the mother* ***D*** *is not correct because only the nucleus was used from the mother and the father's mitochondria do not enter the ovum on fertilisation*	**(1)**

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to three of the following: • zygote divides by mitosis (several times to form blastocyst) (1) • to make identical copies of the {DNA (molecules) / chromatids} (1) • so that all cells (in the blastocyst) {will be diploid / have two copies of each chromosome} (1) • so that when the mitochondria divide they will have a copy of the DNA (1)	**ACCEPT** genetically-identical (daughter) cells / same genetic information **ACCEPT** correct number of chromosome / 46 chromosomes / 23 pairs **ACCEPT** mitochondrial DNA divides	**(3)**

Q15.

Question Number	Acceptable Answer	Additional guidance	Mark
	An explanation that makes reference to one of the following: (1) • interphase because small size of cell shows less growth has taken place (1) • cytokinesis and mitosis are unlikely to occur any faster		**(1)**