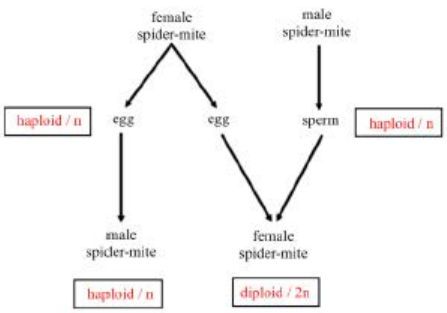
WJEC (Wales) Biology A-level Topic 1.6: Cell Division Questions by Topic - Mark Scheme

1.

Question			Marking details	Marks Available
1.	(a)		Root tip/ shoot tip/ meristem;	1
	(b)		A Anaphase; B Prophase; C Telophase; D Metaphase;	4
	(c)		Interphase; It is the longest phase;	2
	(d)		(All cells) would be {haploid/half the number of chromosomes}; NOT cells have fewer/ less chromosomes (All cells) would be **genetically** different;	2
			Question 1 Total	[9]

2.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)			J, K & M = 2 marks 2 correct = 1 marks 0/1 correct = 0 marks If use more than three letters then deduct one mark for each additional letter		2		2		
	(b)	(i)		 4 correct for 2 marks 2/3 correct for 1 mark 0/1 correct = 0		2		2		
		(ii)		Eggs/ female gametes/ ova are produced by meiosis (1) Sperm/male gametes are produced by mitosis (1)			2	2		
	(c)	(i)		1. 3.4 units DNA {before replication / in early interphase}/ {quantity of DNA halves/ returns to original value} {following cytokinesis / (at the end of)telophase} (1) 2. {6.8 units of DNA/ DNA doubles} due to DNA replication (1) 3. (6.8 units of DNA will be present during) (Late) interphase/ prophase/ metaphase/ anaphase(1)		3		3		
		(ii)		{mitosis is faster/ more mitosis} in young spider mites than older spider mites/ ORA (1) Young spider mite - mitosis required for growth (and repair of muscle tissue) / Older spider mite – mitosis required for repair (of muscle tissue only) (1)			2	2		
				Question 2 total	**0**	**7**	**4**	**11**	**0**	**0**

3.

Question			Marking details	Marks Available
3	*(a)*	(i)	Produce {gametes / sex cells} / halves chromosome number / produces haploid cells / introduce genetic variation;	1
		(ii)	Testes / ovaries;	1
	(b)	(i)	X–centriole **AND** Y–spindle (fibre) / microtubules;	1
		(ii)	**div I** 2 chromosomes in each cell 1 big 1 little; straddling equator; Ignore lack of crossing over **div II** 2 chromosomes in each cell 1 big 1 little; showing correct recombinants;	4
	(c)		1 pair reversed across equator;	1
	(d)	(i)	Prophase I; NOT prophase alone	1
		(ii)	Drawing showing non sister chromatids crossing over; and parts being exchanged; Accept correct annotations or second diagram	2
		(iii)	Crossing over / chiasmata;	1
			Question 3 Total	**[12]**

4. (a)

2 chromosomes in female cell;

1 chromosome in male cell;

Diagrams must match each other.

Accept 'chromatids' in each cell. Do not accept chromatid in male cell if chromosomes drawn in female cell or opposite. [2]

(b)

(i)

2 Chromosomes arranged on equator of spindle; (ignore orientation) [2]

2 V shaped {chromosomes / chromatids} with centrosomes towards each centriole/pole;

Ecf from one diagram to other.

(ii)

Labelling: chromatids, centromere, spindle, centrioles, equator, cell membrane.

2 marks for 4 correct labels on either diagram;

1 mark for 3. [2]

(iii)

To provide {genetically identical cells / clones};

Repair / replacement {of cells / tissue} / regeneration qualified;

NOT growth. [2]

(iv)

Making gametes / sperm cells / sex cells / produce haploid cells for reproduction; [1]

(v)

Meiosis / reduction division;

Spelling must be correct. [1]

(vi)

Genetic variation (in the offspring) / restore diploid number (in zygote) OWTTE; [1]

(c)

Fertilised eggs will develop into females, unfertilised eggs into males; (both for 1 mark);

Accept: fertilised will give genetically varied ants, unfertilised would give clones;

IGNORE haploid / diploid. [1]

Question total 12

5.

Question			Marking details	Marks Available
5	*(a)*	(i)	B, D, C, F, E;	1
		(ii)	Cytokinesis;	1
	(b)	(i)	4 cells are produced compared with 2 / cells are haploid as oppose to diploid/only contain one set of chromosomes compared with two sets of chromosomes; NOT 2 chromosomes (can be neutral) As a result of two (consecutive) divisions;	2
		(ii)	(Meiosis produces haploid gametes which) allows the diploid state to be restored {at fertilisation/in the zygote} / prevents doubling of the chromosome number at fertilisation; Meiosis produces <u>genetically</u> different {gametes/cells} / results in <u>genetic</u> variation (in the offspring);	2
			Question 5 Total	**[6]**

6.

Question				Marking details		Marks Available					
						AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		{A has/meiosis I results in} two {cells/nuclei} and {B has/ meiosis II results in} 4 / A results from one division and B results from two divisions (1)			1		1		1
		(ii)		plane/angle of section of through cell may not include a nucleus (1) (where nucleus visible) may have been cut at different {levels/planes} (1)		1	1		2		2
	(b)			anaphase II meiosis (1) **Any two (x1) from:** Cell is haploid as only 4 chromosomes / resulting cells will {only have one copy of each chromosome/be haploid} (1) if mitosis two copies of each chromosome / lack of homologous pairs (1) if anaphase I each chromosome would have 2 chromatids / (anaphase II) involves the separation of (sister) chromatids (1)			2	1	3		
				Question 6 total		**1**	**4**	**1**	**6**	**0**	**3**

7.

Question			Marking details	Marks Available
7	*(a)*		Any **4** from 1. {nuclear membrane / nucleolus} disappear; 2. chromosomes {shorten / thicken / contracts / condense} / chromatin condenses; 3. (appear as) {two / pair / sister} chromatids; NOT pairing up 4. chromatids joined at centromere; 5. spindle forms; Reject ref to centrioles making spindle fibres Accept labelled diagram for 3, 4 and 5	Max 4
	(b)		5/100 x (24x60) or (24 x 60)/20 = 72 Correct Answer = 2 marks correct calculation, incorrect answer = 1 mark	2
	(c)		Any **3** from 1. both show interphase because DNA {doubles / changes from 2 to 4 / replicates}; NOT DNA increases unqualified 2. (with vincristine) there is {no halving of DNA / DNA does not decrease from 4 to 2 arbitrary units}; 3. (lack of spindle fibres) prevents chromatids being pulled to the {poles / ends of spindle}(in anaphase); allow chromosomes 4. therefore no cytokinesis / no separation into two cells; 5. daughter cells not produced	Max 3
	(d)		meiosis produces genetically different cells AND mitosis produced {genetically identical cells / clones}; meiosis halves chromosome number AND mitosis maintains chromosome number / cells produced by meiosis are haploid AND those by mitosis are diploid ;	2
			Question 7 total	**[11]**

8. (a) **[4]**

Role	Mitosis	Meiosis
	✓	X
	X	✓
	X	✓
	✓	✓

(not: hybrid ticks)

(b) joined pair of chromatids;
chromatid labelled and centromere labelled; **[2]**

(c) centromere splits;
chromatids pulled to (opposite) poles;
by shortening/ contraction of spindle fibres; **[3]**

(d) centrioles; **[1]**

(Total 10 Marks)

9.

(a) (i) Stage A – telophase; 2
Stage C – metaphase;

(ii) Centromeres split/ divide; 2
Chromatids/ chromosomes are being pulled to (opposite) poles;
(due to) contraction/ shortening of the spindle (fibres);

(b) (i) Interphase; 1

(ii) The (quantity of) DNA has doubled / (quantity of) DNA changes from 6 to 12; NOT increase 1

(iii) Meiosis; (correct spelling) 2
(At the end of the cell cycle) the (quantity) of DNA has been halved (and halved again) / can describe with numbers /involves 2 (consecutive) divisions;
Ignore reference to chromosomes

10.

Question		Marking details	Marks Available
(a)		40;	1
(b)	(i)	Correct diagram; two chromosome pairs vertically orientated one of each pair on each side of the equator one pair of chromosomes bigger than the other	1
	(ii)	Correct **labelling** of chromatid, centromere, centriole, spindle fibres 2 marks for 4 correct labels 1 mark for 2 or 3 correct labels	2
	(iii)	Correct diagrams; Two chromosomes in each cell (one large and one small) Centromeres on dotted line	1
	(iv)	{Random/ independent} assortment of {chromosomes/ chromatids}/ description of {random/ independent assortment}; crossing over/ chiasmata; produces haploid cells;	3
		Question10 Total	**[8]**

11. (a) (i) J K L H I — 1

(ii) I = telophase — 1

L = metaphase — 1

(b) (i) interphase — 1

(ii) ATP production/ metabolically active; — 2

Replication of DNA; NOT synthesis/ doubling

{Making/ replacing} new organelles/ replication of mitochondria/ chloroplasts

NOT replication of organelles

Protein synthesis;

Cell increase in size (not growth) (any two)

(c) DNA Doubled / DNA content increased from 20 to 40 — 1

and then halved (to maintain DNA content) (in two daughter cells.) — 1

(ignore reference to chromosomes)

(d) Two genetically identical daughter cells are produced; — 2

{Genetically identical/ clone} of parent cell.

(Total 10 marks)

12.

Question				Marking details	Marks Available					
					AO1	AO2	A03	Total	Maths	Prac
12	(a)	(i)		They have no nucleus/chromosomes NOT DNA	1			1		
		(ii)		Male + Not all homologous/ Different sex chromosomes/ there is one pair where the chromosomes are different/ one large and one small/ X and Y chromosomes It has a Y chromosome	1			1		
		(ii)		I = 6 chromosomes/3pairs + II = 3 chromosomes	1			1		
		(iv)		One large X shaped chromosome and one small ^ shaped chromosome drawn either side of the equator (1) Spindle fibres drawn (1)		2		2		
				Question 2 total	**3**	**2**	**0**	**5**	**0**	**0**