



A-Level Biology

Mitosis and the Cell Cycle

Mark Scheme

Time available: 75 minutes

Marks available: 58 marks

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Mark schemes

1.

(a) Correct answer for 2 marks, 1.286;;

Accept for 1 mark,

1.28571429 (correct answer not to 3 decimal places)

OR

1.285 (incorrect rounding to 3 decimal places)

OR

Evidence of 0.02142857

OR

Evidence of 19 **and** 4 **and** 700

OR

Evidence of 15 **and** 1800 **and** 2500

OR

Evidence of 15 **and** 700

2

- (b) 1. C = prophase **and**
 D = metaphase **and**
 E = anaphase;
2. (In) prophase, chromosomes condense;
Accept chromatin for 'chromosomes' and for 'condense', shorten and thicken
3. (In) prophase **OR** metaphase, centromeres attach to spindle fibres;
4. (In) metaphase, chromosomes/pairs of chromatids at equator/centre of spindle/cell;
5. (In) anaphase, centromeres divide;
6. (In) anaphase, chromatids (from each pair) pulled to (opposite) poles/ends (of cell);
Accept for 'chromatids', chromosomes but reject homologous chromosomes
7. (In) prophase/metaphase/anaphase, spindle fibres shorten;
If mark point 1 is not credited = 4 max
Do not carry forward error from 1.
Accept letters for stages as indicated in 1.
Accept for 'shorten', contract

5 max

[7]

2.

- (a) 1. Chromosomes (are) becoming visible/distinct;
 2. Because (still) condensing;

OR

Accept 'chromosomes are condensed' for 2 marks.
Accept shorten or thicken for 'condensed'

3. Chromosomes (arranged) at random/not lined up;
 4. Because no spindle (activity);

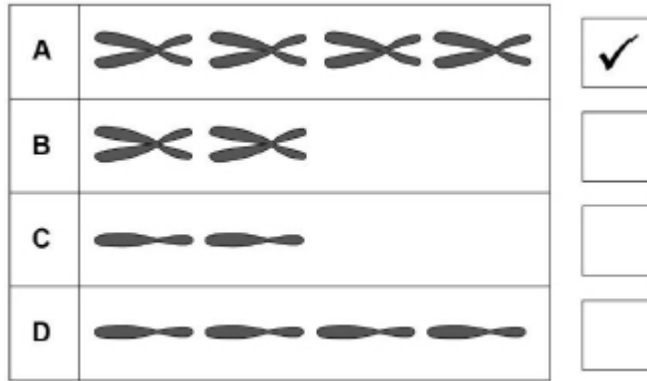
OR

Because not attached to spindle fibres;

Link marking points-
1 and 2
3 and 4

2

(b) A;



1

(c) Locus/loci;

1

- (d) 1. (Because) base/nucleotide sequence;
2. (In) triplet(s);
3. (Determines) order/sequence of amino acid sequence/primary structure (in polypeptide);

3

[7]

3.

(a) 0.1;

1

(b) Accept answer in the range of 4.7 to 4.9;

1

- (c) 1. (Trexall acts as a) competitive inhibitor
OR
(Trexall) competes (with folic acid/substrate) for/is able to fit into/binds at active site (on dihydrofolate reductase / enzyme);
*Reject Trexall and folic acid have the **same** shape*
2. Less folic acid/substrate attaches
OR
Fewer enzyme-substrate complexes;
Accept folic acid/substrate is prevented from binding
3. Fewer/not enough nucleotides available for DNA replication;
Accept fewer/not enough nucleotides available during interphase/for semi-conservative replication/to add to (all) template strands/for transcription

3

(d) **Percentage change**

1. To allow comparison **as** tumours may differ in volume/size (at the start of the investigation);

Tumour volume

2. (As) tumours may differ in length/width/shape
OR
(As) volume is (best) indication of the number of cells in tumour;
Accept 'as tumours are three dimensional'
Ignore answers relating to density/thickness

2

- (e) Answer in the range 32 015.93682 to 32 045 = 2 marks

OR

$$3.20 \times 10^4 = 2 \text{ marks};;$$

Allow 1 mark for correct calculation of volume after treatment in range of 24 011.95261 to 24 034/2.40 $\times 10^4$

Allow 1 mark if student uses diameter throughout instead of radius, in range of 256 127 to 256 361/2.56 $\times 10^5$

Accept any suitable rounding

2 max

- (f)

Accept converse arguments for all mark points.

For (the use of 30 mg)

1. There is a significantly greater reduction (in tumour size with 30 mg), **as** SD (bars) do not overlap;
Accept 'significant difference' for 'significantly greater reduction'
2. In some cases (with 30 mg) there was a 100% reduction in size/tumours would have been eradicated;

Against (the use of 30 mg)

3. There is too much/a lot of variation in effectiveness with 30 mg (in contrast with 20 mg);
Ignore 30 mg has a lot of deviation/large standard deviation' unqualified
4. (No idea of) extra cost of providing 30 mg per week;
5. (Increased risk of) side effects with higher doses;

2 max

(h) Accept any **two** suitable suggestions for **one** mark, eg;

Severity/duration of arthritis

Current/other medication

Type of arthritis

Weight/body mass

Ethnicity

Reject age/health as they are directly in the stem

Ignore gender/sex

Ignore general answers such as diet/activity/lifestyle

1 max

(g)

2 max for answer only giving reasons against

For

1. Pain decreases more with Trexall/Group **R** compared with the control group/Group **S**

OR

Pain decreases by 4.6 with Trexall/Group **R** and by 2 with the control group/Group **S**;

*Ignore numbers stated from the table, eg 9.7 to 5.1 **and** 9.8 to 7.8*

Against

2. Small sample size/only 12 people/only studied females / effects in males could be different;

3. (Mean score for severity of) pain in control group/Group **S** is (also) lower;

Could be subsumed within MP1

4. No statistical testing, **so** do not know if decrease/difference is significant;

*Ignore 'do not know if **results** are significant'*

5. Pain is (a) subjective (measurement);

Accept 'patients might lie about pain'

3 max

[15]

- 4.** (a) 1. Growth / increase in cell number;
Ignore growth of cells
2. Replace cells / repair tissue / organs / body;
Ignore repair cells
Reject bacteria
3. Genetically identical cells;
'Produces 2 genetically identical cells' does not reach MP1 as well as MP3
4. Asexual reproduction / cloning;
Allow example or description
- 2 max**
- (b) (i) (Ensures) representative (sample);
Accept find some cells in mitosis / not in interphase.
Accept 'more reliable' only if linked to percentage (of cells). 'Improves reliability' on its own does not gain this mark
Neutral: Large sample
- 1**
- (ii) 1. A = metaphase;
2. Chromosome / chromatids lie on equator;
Reject homologous chromosomes Allow centre / middle
3. B = anaphase;
4. Chromatids / chromosomes separating / moving apart / moving to poles;
Reject homologous chromosomes
- 4**
- (c) 2 hours / 120 minutes;
Allow 1 mark if working shows candidate understood that mitosis would take 10%
- 2**
- [9]**

- 5.** (a) Interphase / S-phase;
- 1**
- (b) **A D C E B;**
- 1**

- (c) Attachment of centromeres / chromosomes / chromatids; Separation of centromeres / chromatids / chromosomes; 2
- (d) Halves chromosome number / haploid;
Diploid / full number restored at fertilisation;
Allow correct reference to variation

max 2

[6]

6.

- (a) Sequence: C,A,D,B;
1 mark per correct box to 3 max

3 max

- (b) (i) Q;

1

- (ii) Cell/nucleus has divided / is dividing (into two);
Accept – mitosis (occurring)
Ignore refs to chromosomes dividing

1

[5]

7.

- (a) 1. To break down links between/separate cell walls;
2. Allowing the stain to pass/diffuse into the cells

OR

Allowing the cells to be (more easily) squashed;
If neither MP1 or MP2 are present, for 1 mark accept 'to stop any (further) reactions'

2

- (b) 1. To create a single/thin layer of cells

OR

To spread out cells;

2. So that light could pass through;

2

- (c) 1. Anaphase;
Reject 'Anaphase I (of meiosis)'
2. Chromatids are being pulled to opposite poles/ends (of the cell) by spindles/spindle fibres;
Accept chromosomes for chromatids
Reject homologous chromosomes for chromatids

2

(d) 0.13 (0.128205128205128);

Accept any correct rounding except 0.1

1

(e) 1. (Garlic) grown for different lengths of time

OR

(Garlic) grown in different conditions;

Accept suitable descriptions of conditions, eg in different temperatures

2. The root tips from different (garlic) plants/roots/bulbs/species;

3. Single field of view is not representative of a root tip

OR

Different fields of view are different samples;

2 max

[9]