M1. (a) (i) (D) B E A C;

1

(ii) <u>metaphase</u>;

1

(b) interphase/S phase;

1

(c) (i) 0.06 × 100;
6(%);
(correct answer 2 marks)

2

(ii) more(cancer cells) killed, cancer cells divide more (often)
(so are more likely to be killed, more susceptible);

1

(iii) longer time to recover;
reduced rate of mitosis / divide more slowly/
increased doubling time;

2

[8]

M2. (a) Chromosomes attach to equator/middle of cell/spindle;
Prophase;
Anaphase;
DNA replication/synthesis / chromosome copying/duplication;
Telophase;

5

(b) (i) Meiosis;

1

(ii) 32;

1

[7]

M3. (a) (i) (D) B E A C;

1

(ii) Metaphase;

1

(b) Interphase/S phase;

1

(c) (i) Healthy cells not dividing so number stays constant;
Cancer cells dividing (uncontrollably) so increasing in number;

2

(ii) Drug only kills some cancer cells;
These continue to divide;

2

[7]

M4. (a) (i) Cells are in interphase;

Accept G phase/S phase.

1

(ii) Cells undergoing mitosis/in telophase/cytokinesis;

Accept all named stages but reject prophase, metaphase or anaphase on their own.

1

(b) 1. 3 hours;

2. Time between beginnings/endings DNA replication/Increases/levelling outs of DNA concentration/for shape (of curve for replication) to be repeated;

3. (DNA) replication takes place once per cell cycle;

Allow close approximation where candidate attempts to be more accurate.

Principle
What is shown on the graph

3

[5]

M5. (a) (i) 8 'chromatids' each side;
spindle drawn;

2

(ii) 4 chromosomes;
1 from each homologous pair;

2

(b) produces haploid cells / chromosome number halved;
fertilisation;
maintains the diploid / chromosome number (in next generation);

2 max

[6]

M6. (a) (i) anaphase;

1

(ii) sister / identical chromatids (separate);
move to opposite poles / ends / sides;

2

(b) (i) interphase;

1

(ii) ATP production / protein synthesis / replication of centrioles;

1

(iii) 1.2;

1

(c) short duration of interphase;

1

[7]

M7. (a) each strand copied/acts as a template;
(daughter) DNA one new strand and one original/parent strand;

2

(b) (i) ^{15}N/ tube **B** (DNA), more/greater density;
(reject heavier)

1

(ii) DNA with one heavy and one light strand;
new/synthesised strand, made with ^{14}N/ light strand;

2

(c) 32;
28 32 26;

2

[7]

M8. (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]

M9. (a) 1 two strands therefore semi-conservative replication (possible);
2 base pairing/hydrogen bonds holds strands together
3 hydrogen bonds weak/easily broken, allow strands to separate;
4 bases (sequence) (exposed so) act as template /can be copied;
5 A with T, C with G / complementary copy;
6 DNA one parent and one new strand;

4 max

(b) 1 chromosomes shorten/thicken/supercoiling;
2 chromosomes (each) two identical chromatids/strands/copies (due to replication);
3 chromosomes/chromatids move to equator/middle of the spindle/cell;
4 attach to individual spindle fibres;
5 spindle fibres contract / centromeres divide / repel;
6 (sister) chromatids/chromosomes (separate) move to opposite poles/ends of the spindle;
7 each pole/end receives all genetic information/ identical copies of each chromosome;
8 nuclear envelope forms around each group of chromosomes/ chromatids/at each pole;

7 max

(c) cancer cells killed, normal body cells survive;
cancer cells low oxygen (as blood supply cannot satisfy demand);

2

[13]

M10. (a) (i) Spindle formed / chromosome/centromere/chromatids attaches to spindle;

Chromosomes/chromatids line up/move to middle/equator (of cell);

Do not award second mark for answers referring to chromosomes 'pairing up'.

Ignore reference to homologous chromosomes unless context suggests pairing which negates second mark.

Neutral: Details on nuclear membrane.

Accept: Diagram for second marking point.

2

(ii) Chromosome/centromere splits / chromatids/ 'chromosomes' separate/pulled apart;

To (opposite) sides/poles/centrioles (of cell);

Reject: Homologous chromosomes separate for first marking point.

Accept: Diagram for second marking point.

Chromatids/ 'chromosomes' move to poles/sides/centrioles = 2 marks.

2

(b) (i) Form/replace cells quickly/rapidly / divide/multiply/replicate rapidly;

Neutral: Repair cells.

Answers must convey idea of 'speed'.

1

(Ii) Correct answer = 774 minutes/ 12 hours 54mins = 2 marks;;

Incorrect answer but indicates 3 cell cycles involved = one mark;

2

(c) Prevents/slows DNA replication/doubling;

Prevents/slows mitosis;

New strand not formed / nucleotides (of new strand) not joined together / sugar-phosphate bonds not formed;

First marking point must be in context of DNA replication not cell replication.

Do not negate first marking point if role of DNA polymerase is described incorrectly e.g. Reject: 'joins bases/strands together'.

Role of DNA polymerase must be correct for last marking point.

2

[9]

M11. (a)

Nucleus	Number of chromosomes	Mass of DNA/arbitrary units
At telophase of mitosis	26;	30;
From a sperm cell	13;	15;

4

(b) Cancer cells often have faulty/damaged DNA;

Protein/p53 faulty/not made;

Cell (with faulty /DNA) divides/completes cell cycle;

Uncontrolled division produces cancer;

p53 refers to the protein so do not accept reference to p53 mutating.

3

(c) (i) Interphase/S phase/synthesis phase;

1

(ii) Anaphase/**A**;

1

[9]