M1. (a) **C**

1

(b) cytoplasm **and** cell membrane dividing

*accept cytokinesis for **1** mark*

1

to form two identical daughter cells

1

(c) stage 4

1

only one cell seen in this stage

1

(d) (4 / 36) × 16 × 60

1

107 / 106.7

1

110 (minutes)

*allow 110 (minutes) with no working shown for **3** marks*

1

(e) binary fission

*do **not** accept mitosis*

1

(f) shortage of nutrients / oxygen

1

so cells die
or
death rate = rate of cell division

1

[11]

M2. (a) hold <u>cells</u> together **or** prevent flow of <u>cells</u> **or** trap <u>cells</u>

1

(b) 12500

if correct answer, ignore working / lack of working

$\frac{100}{0.008}$ *for **1** mark*

ignore any units

2

(c) (i) size RBC approximately same size capillary **or**
no room for more than one cell **or**
<u>only</u> one can fit **or**
RBC is <u>too</u> big

allow use of numbers

*do **not** accept capillaries are narrow*

1

(ii) more oxygen released (to tissues) **or**
more oxygen taken up (from lungs)

1

and any **two** from:

- slows flow **or** more time available
- shorter distance (for exchange) **or** close to cells / capillary wall
- more surface area exposed

2

[7]

M3. (a) any **two** from:

- sterilise / kill microorganisms
  ignore 'cleaning' / 'disinfect'
  ignore 'germs'
- method of sterilisation eg apparatus / media sterilised in oven / autoclave
  allow pressure cooker / boiling water
- pass flask mouth / pipette tip / loop / test tube mouth through flame
- work near a flame
- minimise opening of flask / test tube **or** hold non-vertical
  *allow idea of sealing / covering **or** prevent entry of air*

2

(b) any **two** from:

- temperature
  ignore references to time / type of bacterium
- concentration / amount of nutrients / ions
- type of nutrient
- volume / amount of solution
- amount of bacteria added
- agitation **or** amount of oxygen

2

(c) (i) 7.5
accept in range 7.4 – 7.6

1

(ii) use more pH values around / close to pH 7.5 / between 7 and 8

1

[6]

M4. (a) **A** cytoplasm

in this order only

1

B (cell) membrane

*do **not** accept (cell) wall*

1

(b) (i) synapse

1

(ii) (as) chemical

accept neurotransmitter or named

ignore references to how the chemical is passed

*do **not** accept electrical*

1

(c) (from light-sensitive cell to connecting neurone) to sensory neurone

ignore references to synapses accept 'nerve cell' for neuron(e) throughout penalise 'nerve' for neurone once only

1

(sensory neurone) to brain / CNS

allow (sensory neurone) to relay neurone / spinal cord

1

(brain / CNS) to motor neurone

allow (relay neurone / spinal cord) to motor neurone

1

(motor neurone) to (eyelid) muscle

ignore effector

1

[8]

M5. (a) (i) diffusion is down the concentration gradient

for a description of diffusion
ignore along / across gradients

1

to enter must go up / against the concentration gradient

accept by diffusion ions would leave the root

or

concentration higher in the root / plant

or

concentration lower in the soil

1

(ii) active transport

allow active uptake

1

(b) (i) (root hairs →) large surface / area

1

(ii) (aerobic) respiration

*do **not** allow anaerobic*

1

releases / supplies / provides / gives energy

accept make ATP (for active transport)
*do **not** allow 'makes / produces / creates' energy*

1

(iii) starch is energy source / store (for active transport)

allow starch can be used in respiration
*do **not** allow 'makes / produces / creates' energy*

1

[7]

M6. (a) both parents **Aa**

*accept other upper and lower case letter without key **or** symbols with a key*

allow as gametes shown in Punnett square

1

aa in offspring correctly derived from parents
or
aa correctly derived from the parents given

ignore other offspring / gametes

for this mark parents do not have to be correct

1

offspring **aa** identified as having cystic fibrosis

*may be the only offspring shown **or** circled / highlighted / described*

1

(b) (i) any **one** from:

accept converse if clear, eg if you (only) took one it might have cystic fibrosis / might not be fertilised

- (more) sure / greater chance of healthy / non-cystic fibrosis egg / embryo / child

  accept some may have the allele

  reference to 'suitable / good embryo' is insufficient

- greater chance of fertilisation

1

(ii) **advantages**

to gain 3 marks both advantage(s) <u>and</u> disadvantage(s) must be given

max 3

any **two** from:

ignore references to abortion unless qualified by later screening

- greater / certain chance of having child / embryo without cystic fibrosis / healthy
- child with cystic fibrosis difficult / expensive to bring up
- cystic fibrosis (gene / allele) not passed on to future generations

disadvantages

any **two** from:

- operation dangers / named eg infection
  ignore risk unqualified
- ethical or religious issues linked with killing embryos
  accept wrong / cruel to embryos accept right to life argument
  ignore embryos are destroyed
- (high) cost of procedure
- possible damage to embryo (during testing for cystic fibrosis / operation)

plus

conclusion

a statement that implies a qualified value judgement
eg it is right because the child will (probably) not have cystic fibrosis even though it is expensive
or
eg it is wrong because embryos are killed despite a greater chance of having a healthy baby

***note**: the conclusion mark cannot be given unless a reasonable attempt to give both an advantage and a disadvantage is made*

*do **not** award the mark if the conclusion only states that advantages outweigh the disadvantages*

1

(c) any **three** from:

- osmosis / diffusion

  *do **not** accept movement of ions / solution by osmosis / diffusion*

- more concentrated solution outside cell / in mucus

  assume concentration is concentration of solute unless answer indicates otherwise or accept correct description of 'water concentration'

- water moves from dilute to more concentrated solution

  allow correct references to movement of water in relation to concentration gradient

- partially permeable membrane (of cell)

  allow semi / selectively permeable

3

[11]

M7. (a) (i) mitochondrion / mitochondria

must be phonetically correct

1

(ii) carbon dioxide / CO_2

1

water / H_2O

1

in either order

*accept CO2 but **not** CO^2*

*accept H2O **or** HOH but not H^2O*

(iii) diffusion

1

high to low concentration

allow down a concentration gradient

1

through (cell) membrane **or** through cytoplasm

*do **not** accept cell wall*

1

(b) ribosomes make proteins / enzymes

1

using amino acids

1

part A / mitochondria provide the energy for the process

allow ATP

*do **not** accept produce or make energy*

1

[9]