Mark schemes

1

(a) nucleus labelled correctly

1

cell membrane labelled correctly

1

(b) mitosis

1

(c) electron (microscope)

1

(d) higher magnification

1

(e) 45 (mm)

1

45 / 250 **or** 0.18 (mm)

allow ecf

1

180 (µm)

1

*allow 180 (µm) with no working shown for **3** marks*

(f) 0.2 µm

1

[9]

2

(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]

3

Level 3 (5–6 marks):
A detailed and coherent explanation is provided with most of the relevant content, which demonstrates a comprehensive understanding of the human circulatory system . The response makes logical links between content points.

Level 2 (3–4 marks):
The response is mostly relevant and with some logical explanation. Gives a broad understanding of the human circulatory system. The response makes some logical links between the content points.

Level 1 (1–2 marks):
Simple descriptions are made of the roles of some of the following: heart function, gas exchange, named blood vessels, named blood cells. The response demonstrates limited logical linking of points.

0 marks:
No relevant content.

Indicative content

- dual / double circulatory system which means that it has higher blood pressure and a greater flow of blood to the tissues
- heart made of specialised (cardiac) muscle cells which have long protein filaments that can slide past each other to shorten the cell to bring about contraction for pumping blood
- heart pumps blood to lungs in pulmonary artery so that oxygen can diffuse into blood from air in alveoli
- blood returns to heart via pulmonary vein where muscles pump blood to the body via aorta
- oxygen carried by specialised cells / RBCs which contain haemoglobin to bind oxygen and have no nucleus so there is more space available to carry oxygen
- arteries carry oxygenated blood to tissues where capillaries deliver oxygen to cells for respiration and energy release
- thin walls allow for easy diffusion to cells
- large surface area of capillaries to maximise exchange
- waste products removed eg CO_2 diffuse from cells into the blood plasma
- blood goes back to the heart in veins which have valves to prevent backflow
- cardiac output can vary according to demand / is affected by adrenaline

accept annotated diagrams

[6]

4 (a) (i) nucleus

1

(ii) diffusion

1

(b) increases / larger surface area (for diffusion)

ignore large surface area to volume ratio

1

(c) (i) sugar / glucose

accept amino acids / other named monosaccharides

1

(ii) against a concentration gradient

or

from low to high concentration

1

(iii) (active transport requires) energy

1

(from) respiration

1

(d) minerals / ions

accept named ion ignore nutrients

***do not accept** water*

1

[8]

5 (a) A (inoculating / wire) loop

1

B Petri dish

allow (agar) plate

ignore ref to culture medium

1

(b) (i) to kill (unwanted) bacteria / microorganisms / microbes

allow fungi

ignore viruses / germs

1

(ii) Using a flame

1

(iii) any **one** from:

- so bacteria / microorganisms / microbes / pathogens / fungi (growing in dish) do not get out

  ignore reference to gases

  ignore viruses / germs

- so bacteria / microorganisms / microbes / pathogens / fungi (from the air) do not get in.

  ignore viruses / germs

1

(c) 25 °C

1

[6]

6 (a) **A** = nucleus

allow phonetic spelling

1

B = (cell) membrane

1

(b) for repair / growth **or** to replace cells

ignore new cells / skin

1

(c) (i) embryos

1

(ii) paralysis

1

[5]

7 (a)

Structure	Organ	Organ system	Tissue
Stomach	✓		
Cells lining the stomach			✓
Mouth, oesophagus, stomach, liver, pancreas, small and large intestine		✓	

all 3 correct = 2 marks
2 correct = 1 mark
1 or 0 correct = 0 marks

2

(b) (i) diffusion

allow phonetic spelling

1

(ii) glucose

1

(iii) mitochondria

1

[5]

8 (a) contract / shorten

ignore relax
*do **not** allow expand*

1

to churn / move / mix food

accept peristalsis / mechanical digestion
ignore movement unqualified

1

(b) 400

acceptable range 390-410
allow 1 mark for answer in range of 39 to 41
allow 1 mark for answer in range of 3900 to 4100

2

(c) to transfer energy for use

allow to release / give / supply / provide energy
*do **not** allow to 'make' / 'produce' / 'create' energy*
allow to make ATP
ignore to store energy

1

by (aerobic) respiration **or** from glucose

*do **not** allow anaerobic*

*energy released **for** respiration = max 1 mark*

1

(d) (i) to make protein / enzyme

ignore 'antibody' or other named protein

1

(ii) too small / very small

allow light microscope does not have sufficient magnification / resolution

allow ribosomes are smaller than mitochondria

ignore not sensitive enough

ignore ribosomes are transparent

1

[8]

9 (a) (i) chloroplast

1

(ii) cell wall

1

(b) (i) osmosis

accept diffusion

1

(ii) cell wall (prevents bursting)

1

(c) (i) carbon dioxide

allow correct formula

1

glucose

allow sugar / starch

1

(ii) any **two** from:

- light sensitive spot detects light
- tells flagellum to move towards light
- more light = more photosynthesis

2

(d) (cell has) larger SA:volume ratio

1

short (diffusion) distance

allow correct description

1

(diffusion) via cell membrane is sufficient / good enough

or

flow of water maintains concentration gradient

1

[11]

10 (a) (i) xylem

1

(ii) water

1

minerals / ions / named example(s)

ignore nutrients

1

(b) (i) movement of (dissolved) sugar

allow additional substances, eg amino acids / correct named sugar (allow sucrose / glucose)

allow nutrients / substances / food molecules if sufficiently qualified

ignore food alone

1

(ii) sugars are made in the leaves

1

so they need to be moved to other parts of the plant for respiration / growth / storage

1

(c) (i) mitochondria

1

(ii) for movement of minerals / ions

Do not accept 'water'

1

against their concentration gradient

1

[9]

11 (a) any **two** from:

- only one 'chromosome'

  allow one strand of DNA
- circular

  allow loop
- may have plasmids
- not in a nucleus / no nucleus

2

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

- London is much higher
  or converse
- more variable / wider range
  allow 'on average it is 5 / 6 times greater'

1

(ii) increases
Included figures must be correct

1

(iii) overall slight increase
accept 'doesn't change much'

1

variable / goes up and down

1

(c) (i) both axes correctly labelled

x = Year

y = Number of cases

1

correct points
*all correct = **2** marks*
*1-2 errors = **1** mark*
*> 2 errors = **0** marks*

2

suitable line of best fit
accept straight line or smooth curve

1

(ii) doesn't fit the pattern / line of best fit

1

(d) provides immunity / protection (to TB)
ignore 'stops people catching it'
ignore 'resistance'

1

prevents TB <u>spreading</u>
accept ref to herd immunity

1

[13]

12 (a) (i) Chromosomes

1

(ii) Characteristics

1

(iii) Classify

1

(b) Plants

ignore algae

1

[4]

13 (a) (i) A = (cell) membrane

1

B = cytoplasm

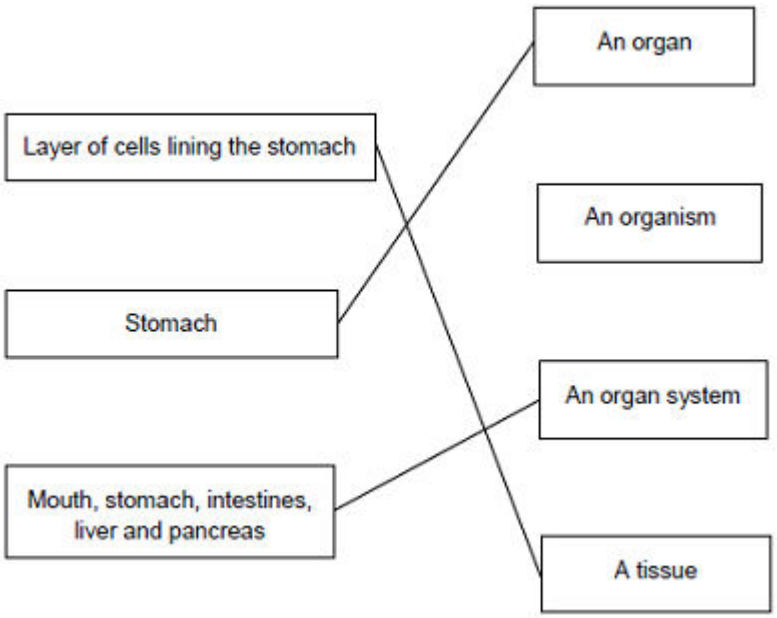
*do **not** accept cytoplast*

1

(ii) To control the activities of the cell

1

(b)



extra lines cancel

3

[6]

14 (a) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking guidance, and apply a 'best-fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1-2 marks)
There is a brief description of at least one of the stages (pre-inoculation, inoculation, post-inoculation).

Level 2 (3-4 marks)
There is a simple description of at least two stages and an explanation of at least one of them.

Level 3 (5-6 marks)
There is a clear description of all three stages and an explanation of at least two of them.

Examples of Biology points made in the response:

Pre-inoculation

- Petri dish and agar sterilised before use
- to kill unwanted bacteria
- inoculating loop passed through flame / sterile swab
- to sterilise / kill (other) bacteria

Inoculation

- loop/swab used to spread/streak bacterium onto agar

Allow other correct methods, eg bacterial lawns

- lid of Petri dish opened as little as possible
- to prevent microbes from air entering

Post-inoculation

- sealed with tape
- to prevent microbes from air entering
- incubate
- to allow growth of bacteria

6

(b) (i) bacteria killed / destroyed
ignore fights / attacks / stops growth / got rid of

1

(ii) *Might be correct*

largest area / space where no bacteria are growing
allow most bacteria killed

1

Might not be correct

(need more evidence as) D may be harmful to people / animals / surfaces
ignore ref to cost / dangerous or harmful unqualified

1

or may work differently with different bacteria

or disinfectants may be different concentrations

ignore different amounts of disinfectant unless reference to different drop size

or may not last as long

ignore take longer to work

allow reference to anomalous result or not repeated

[9]

15 (a) (i) A = nucleus

1

B = (cell) membrane

1

(ii) any **two** from:

ignore shape

- no (cell) wall
- no (large / permanent) vacuole
- no chloroplasts / chlorophyll

2

(b) because high to low oxygen / concentration **or** down gradient

allow 'more / a lot of oxygen molecules <u>outside</u>'

ignore along / across gradient

1

(c) a tissue

1

[6]

16 (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]

17 (a) **A** sperm

1

B egg

1

C fertilised egg

1

D embryo

1

(b) insert into mother

ignore fertilise / check fertilisation / check viability

1

womb / uterus

1

(c) (i) one quarter

1

(ii) no / little chance of success over 42

1

reference to table of only two women in the age bracket 40-42 years became pregnant

*the statement 'only 2 out of 53 40-42 year old women became pregnant / had babies' gains **2** marks*

1

(iii) so fewer twins / multiple births
or
multiple births more dangerous

1

[10]

18 (a) (i) **C** and **D**

no mark if more than one box is ticked

1

(ii) any **one** from:

*do **not** allow if other cell parts are given in a list*

- (have) cell wall(s)
- (have) vacuole(s)

1

(b) (i) **A**

apply list principle

1

(ii) **D**

apply list principle

1

(c) respiration

apply list principle

1

[5]

19 (a) **B**

*no mark for "B" alone, the mark is for B **and** the explanation.*

large(r) surface / area **or** large(r) membrane

accept reference to microvilli

ignore villi / hairs / cilia

accept reasonable descriptions of the surface eg folded membrane / surface

*do **not** accept wall / cell wall*

1

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

- (salivary) amylase
- carbohydrase

1

(ii) <u>many</u> ribosomes

*do **not** mix routes. If both routes given award marks for the greater.*

1

ribosomes produce <u>protein</u>

accept amylase / enzyme / carbohydrase is made of protein

or

(allow)

<u>many</u> mitochondria (1)

mitochondria provide energy to build / make <u>protein</u> (1)

accept ATP instead of energy

1

[4]

20 (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

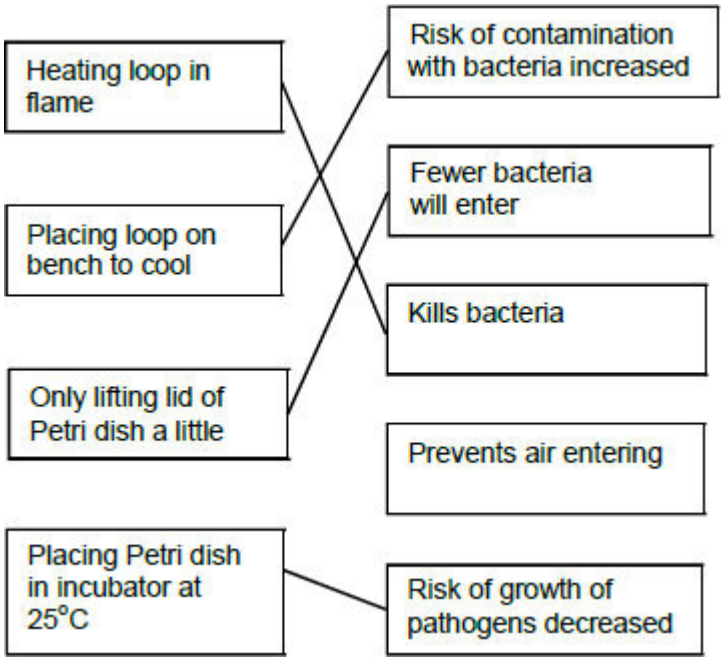
- partially permeable membrane (of cell)

  allow semi / selectively permeable

3

[11]

21



any box on the left joined to > 1 other box - cancel

[4]

22

(a) (i) A = (cell) wall

ignore cellulose

1

B = cytoplasm

1

(ii) any **one** from:

accept has DNA instead of a nucleus, but not just has DNA

- bacterial cell / it has no nucleus
  allow no mitochondria
- DNA free in cytoplasm
  ignore size
- has no vacuole / no vesicles
  ignore strands of DNA

1

(b) (i) <u>yeast</u> grows best / better / well **or** optimum temperature for <u>yeast</u> / more <u>yeast</u> present

allow <u>yeast</u> works best / better / well

1

(yeast) makes CO_2 **or** respires / respiration

allow fermentation

1

(ii) <u>bacterium</u> grows best / better / well / more <u>bacteria</u> present **or** optimum temperature for <u>bacterium</u>

ignore microorganisms / microbes

allow works / respires best / better / well

1

(bacterium) makes (lactic) acid

*do **not** allow wrong acid*

1

[7]

23 (a) (i) **A** − (cell) wall

1

B − cytoplasm

1

C − plasmid

1

(ii) bacterium cell has cell wall / no nucleus / no mitochondria / plasmids present

accept its DNA / genetic material is not enclosed / it has no nuclear membrane

it = bacterium cell

accept converse for animal cell

ignore flagella

1

(iii) any **one** from:

- chloroplast

  ignore chlorophyll
- (permanent) vacuole

1

(b) (Long tail) moves the sperm / allows the sperm to swim

1

towards the egg

allow correct reference to other named parts of the female reproductive system

1

(Mitochondria) release <u>energy</u> (for movement / swimming)

allow supply / produce / provide

1

in respiration

1

[9]

24 (a) (i) 25°C

1

(ii) pathogens

1

(b) **D**

1

more / most bacteria killed

accept biggest area / ring where no bacteria are growing

1

(c) viruses live inside cells

1

[5]

25 (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]