Cells and continuity of cells test – mark scheme

1.

Statement	Prokaryotic cell	Eukaryotic animal cell	Eukaryotic plant cell
Cell wall is present	✓	✗	✓
Chloroplasts may be present	✗	✗	✓
Deoxyribonucleic acid is present	✓	✓	✓

[½] mark off a maximum of [4], for each incorrect answer [4]

2. **(a)** A: cell wall/middle lamella;
B: stroma;
C: granum/thylakoids/lamellae;
D: starch grain; [4]

(b) Granum width = 20 × 1000 = 20 000 µm (unit conversion);
÷ 30 000 (divide by magnification) = 0.67 µm; [2]

3. **(a)** (Rough) endoplasmic reticulum; [1]

(b) Protein/glycoprotein/liped/cholesterol; [1]

(c) **Any two from**
- export contents of vesicle from cell/exocytosis
- formation of primary lysosomes
- digestion of material imported by endocytosis
- breakdown of old/unwanted organelles/autophagy
- breakdown of old cells/autolysis
- formation of cell plate in plant cells
- maintenance of cell membrane [2]

(d) Golgi apparatus will disappear from cytoplasm; [1]

(e) **Any three from**
- the enzymes are initially synthesised on rough endoplasmic reticulum
- transferred in vesicles from ER to Golgi body
- fuse with Golgi body at the formative (cis-) face
- processed within Golgi body/packaged into vesicles (lysosomes)
- which bud off the mature (trans-) face

4. **(a)** The ability to distinguish between two separate objects; [1]

(b) **Any two from**
- dead specimens
- increased chance of artefacts
- black and white image [2]

5. **(a)** **(i)** Telophase;
metaphase;
prophase;
anaphase; [4]

(ii) C, B, D, A; [1]

(b) **(i)** Chiasma(ta);
centromere/kinetochore; [2]

(ii) A section of chromatid of one chromosome is exchanged with a chromatid of the other homologue/crossing over of homologous chromosomes;
resulting in genetic recombination/genetic information is exchanged/swapped;
Reward each point only if the event and consequence are clearly distinguished [2]

6. **(a)** Mitochondria are bounded by an envelope in which the inner membrane is folded/forms cristae;
their function is to generate ATP/aerobic respiration; **i.e. don't write sausage shaped!** [2]

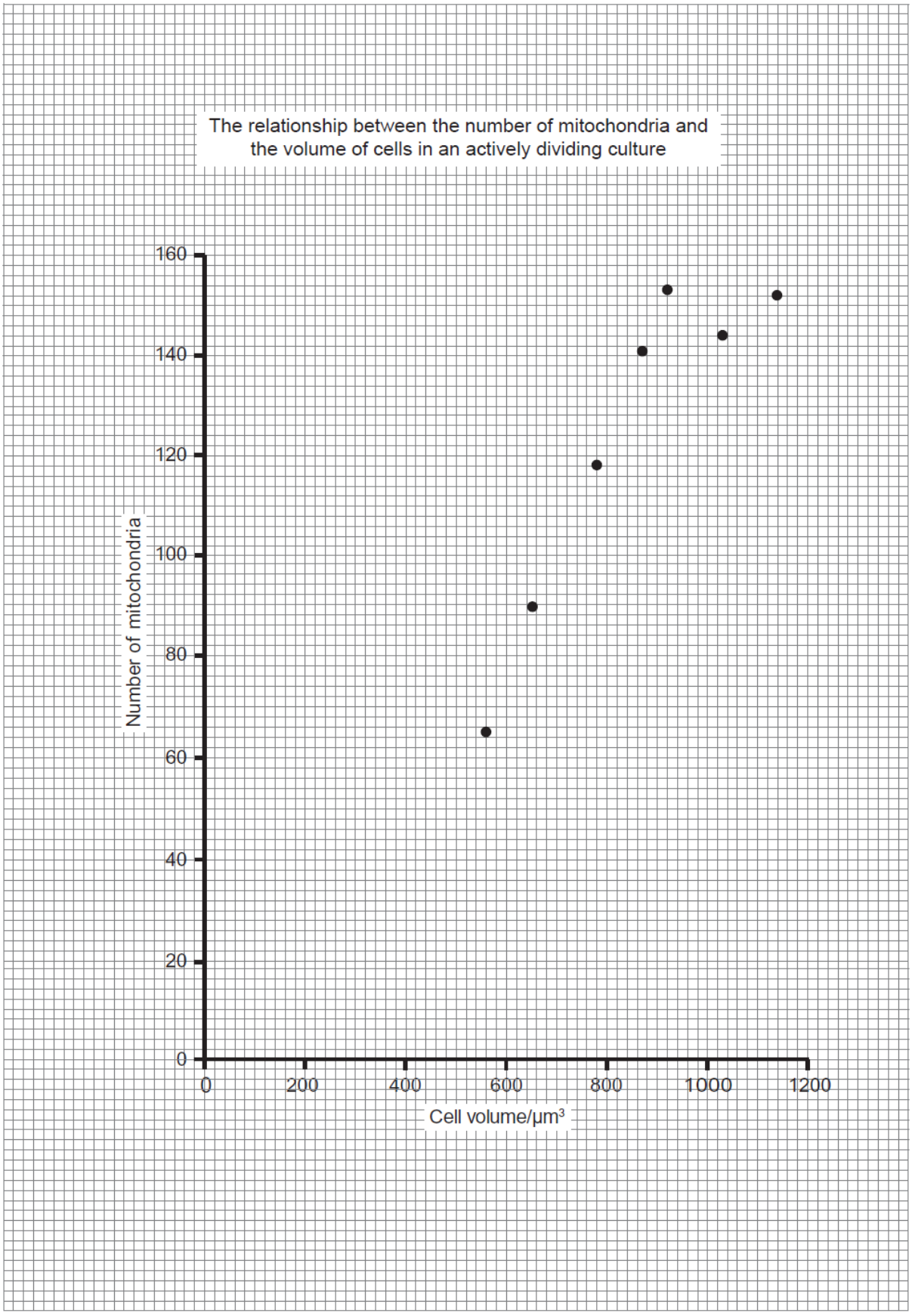
(b) **(i)** Caption;
scaling of the graph (using the graph paper to maximal effect);
labels and units of measurement shown;
points accurately plotted **[6/7 points for 2 marks/5 points for 1 mark]**;
scattergram (points not joined, though line of best fit may be drawn); [6]

(ii) Larger cells (up to a certain size) possess a greater number of mitochondria;
over a certain size the number of mitochondria remains steady/fluctuates; [2]

(iii) **Any two from**
- mitochondria divide (replicate themselves)
- mitochondria produced during the G1 phase (of interphase)
- cells grow during the G phases/interphase
- mitochondria generate energy for cell growth (division)
- an increase in mitochondria (organelles) increases the size of cells
- there is a maximum size to which cells grow
- other appropriate response [2]

(c) **Any two from**
- DNA in prokaryotic cells is naked, i.e. is not associated with protein/DNA in eukaryotic cells is bounded by proteins (histones)
- prokaryotic cells may contain extrachromosomal DNA/plasmids
- prokaryotic cells have smaller (70s) ribosomes/eukaryotic cells have larger (80s) ribosomes
- prokaryotic cells have a cell wall of peptidoglycan/some eukaryotic cells (i.e. animal cells) lack a cell wall/have a cellulose cell wall (plant cells) or chitin cell wall (fungal cells)
- prokaryotic cells are much smaller, rarely exceeding 2 µm in width/eukaryotic cells are generally greater than 5 µm in size
- bacterial cells are prokaryotic while animal, plant and fungal cells are eukaryotic
- other appropriate example [2]

(6. (b) (i))


The relationship between the number of mitochondria and the volume of cells in an actively dividing culture
Number of mitochondria
160
140
120
100
80
60
40
20
0
0
200
400
600
800
1000
1200
Cell volume/μm³

7. **(a)** **(i)** A: mitochondrion;
B: rough endoplasmic reticulum; [2]

(ii) **Any two from**
- nucleus/nucleolus/nuclear envelope
- Golgi body/smooth ER
- vacuole/vesicles/lysosomes
- centrioles
- other appropriate response [2]

(b) **(i)** A: protein/glycoprotein
B: RNA; [2]

(ii) To produce DNA;
from RNA template/which is single stranded; [2]

(c) **(i)** Mitosis;
Spelling must be precise. [1]

(ii) **Any two from**
- the virus cannot synthesise proteins
- the virus cannot synthesise nucleic acid
- it cannot metabolise/synthesise ATP
- the virus has no cell membrane (to evaginate/extend)
- the virus cannot undertake mitosis
- the virus requires a host cell to be active
- other appropriate response [2]

Section B

AVAILABLE MARKS

8 (a) Behaviour of chromosomes during a cell cycle with mitosis:

Any eight points

- during G1/and G2 of interphase the chromosomal material is unwound/ appears as chromatin
- some of this is inactive, heterochromatin
- while some is active, euchromatin
- during the S phase of interphase DNA is replicated
- chromosomes are replicated as new histones bind to the DNA/DNA replication is semi-conservative
- during prophase chromosomes condense (coil and fold up) and become apparent
- each chromosome appears as a pair of chromatids
- during metaphase chromosomes attach to the spindle fibres at the cell equator
- attachment occurs via their centromeres
- during anaphase chromatids are pulled apart/separate
- and move to opposite poles
- during telophase chromosomes begin to unwind again/change to diffuse active form/chromatin
- cells divide into two during cytokinesis halving the amount of chromosomal material
- daughter cells contain the same chromosome number as the parent cell [8]

(b) Different behaviour of chromosomes during mitosis and meiosis:

Any five points

- mitosis involves the separation of the chromatids into new daughter cells
- thus maintaining the same chromosome number as the parent cell (allow if not awarded in part (a))
- the daughter cells are genetically identical to the parent cell
- during prophase I of meiosis the homologous chromosomes pair to form bivalents
- while chiasmata (points of fusion) occur between chromatids of the homologous pair
- the consequence of this is the recombination/crossing-over of alleles on different chromosomes
- during the first division of meiosis the homologous chromosomes are separated into two intermediary daughter cells
- since the homologous pairs arrive randomly on the spindle/the chromosomes are independently assorted when subsequently separated
- in the second division of meiosis the chromatids are separated
- meiosis results in the production of haploid cells
- which are genetically variable [5]