1. skeletal muscle fibres are larger / have many nuclei / are not typical cells; fungal hyphae are (sometimes) not divided up into individual cells; unicellular organisms can be considered acellular; because they are larger than a typical cell / carry out all life functions; some tissues / organs contain large amounts of extracellular material; eg vitreous humour of eye / mineral deposits in bone / xylem in trees / other example; statement of cell theory / all living things / most tissues are composed entirely of true cells;  [4]

2. Award [1] for each of the following structures clearly drawn and labelled correctly in a diagram of a plasma membrane.
   phospholipid bilayer;
   protein channels / integral (intrinsic) membrane proteins;
   peripheral (extrinsic) proteins associated with the membrane;
   cholesterol embedded in the membrane;
   glycoproteins / receptor proteins on the outside;
   hydrophobic and hydrophilic portions of membrane indicated; (both needed for [1])  [5]

3. Award [1] for each of the following structures clearly drawn and labelled correctly in a diagram of a generalized prokaryotic cell.
   size stated: 1 to 10 μm;
   cell wall;
   cytoplasm;
   flagella / flagellum;
   mesosome;
   plasma membrane;
   ribosomes;
   nucleoid region / DNA not enclosed in nuclear membrane;
   plasmid;
   pili;
   capsule / slime layer; 6 max
   Deduct [1] for each eukaryotic feature included, up to [3 max].  [6]
4. labelled diagram of generalized prokaryotic (P) and generalized eukaryotic (E) animal cell

(Marks must be awarded if the following comparisons are made as either annotations to the diagram or in narrative / table form.)
P is usually smaller in size, E is larger;
both have cytoplasm / protoplasm;
P has no nucleus / nucleoid region, E has (membrane-bound) nucleus;
P has one chromosome / circular, E has two or more chromosomes;
P has DNA only, E has DNA with protein (histones);
P has no membrane-bound organelles, E has some membrane-bound organelles;
E has mitochondria, P does not;
E has other example of organelle, P does not;
both can have a flagellum / flagella;
if flagella then E has 9+2 fibrils, P does not;
P can have pili / slime layer / capsule, E does not;
P can have plasmids, E does not;
both have ribosomes;
P has small ribosomes, E has larger ones;
both have cell membrane;
P has cell wall, E has no cell wall;
E has centriole, P has no centriole;  

5. (a) Award [1] for any of the following clearly drawn and correctly labelled.
- phospholipids (bilayer);
- hydrophilic heads and hydrophobic tails;
- intrinsic / integral proteins / protein channels;
- glycoproteins / receptor proteins / glycolipids on outside;
- cholesterol embedded in membrane;
- extrinsic / peripheral proteins;
- thickness size 10 nm (0.1 μm);
(b) Award [1] for each correct row, up to [5 max].

<table>
<thead>
<tr>
<th>Aerobic respiration</th>
<th>Anaerobic respiration</th>
</tr>
</thead>
<tbody>
<tr>
<td>occurs in mitochondria</td>
<td>occurs in cytoplasm;</td>
</tr>
<tr>
<td>requires O₂</td>
<td>occurs without O₂;</td>
</tr>
<tr>
<td>both produce pyruvate from glucose (glycolysis);</td>
<td></td>
</tr>
<tr>
<td>uses fatty acids / lipids / amino acids</td>
<td>doesn’t use fatty acids;</td>
</tr>
<tr>
<td>(Krebs cycle) produces CO₂ and H₂O</td>
<td>(fermentation) produces ethanol / CO₂ (in yeast);</td>
</tr>
<tr>
<td>(Krebs cycle) produces CO₂ and H₂O</td>
<td>(fermentation) produces lactate in animals (humans);</td>
</tr>
<tr>
<td>NADH produced in both;</td>
<td></td>
</tr>
<tr>
<td>large amount of ATP (36 per glucose molecule) produced</td>
<td>small amount of ATP (2 per glucose molecule) produced;</td>
</tr>
</tbody>
</table>

5 max

(c) messenger / mRNA attaches to ribosome (small unit); many ribosome / polyribosomes bind to same mRNA; carries codons / triplet of bases each coding for one amino acid; transfer / tRNA each have specific anticodon; triplet of bases for specific amino acid; tRNA carries specific amino acid; tRNA binds to ribosomes; to corresponding triplet base / codon; a second tRNA binds to next codon; two amino acids bind together; in a peptide linkage; first tRNA detaches; ribosome moves along mRNA; another tRNA binds to next codon; continues until polypeptide / protein formed to stop codon; stop codon has no corresponding tRNA / amino acid / causes release of polypeptide; 8 max

(Plus up to [2] for quality)
6. (a) Award [1] for any of the following clearly drawn and correctly labelled. Award [2 max] if two or more eukaryotic structures are given and if a nucleus is included award [0].
- cell wall / capsule / slime wall / layer;
- plasma / cell membrane;
- mesosome;
- cytoplasm;
- ribosomes;
- nucleoid / naked DNA;
- flagella;
- pili;
- plasmid;
- size stated 1 to 10 μm; 4 max

(b) two cell divisions / reduction-division / diploid to haploid / meiosis I and meiosis II;
- produce four (haploid) cells;
- for production of sex cells / gametes / spores;
- daughter cells are different from parent cells;
- homologous chromosomes / two chromatids pair up;
- line-up on equator;
- (spindle fibres) pull homologous chromosomes to opposite poles;
- two haploid cells are formed;
- second division / like mitosis, separates chromatids to opposite poles; 6 max

Accept any of the above points if clearly explained in a labelled diagram.

(c) FSH stimulates (in first few / five days) follicle development (in ovary);
- (FSH stimulates) follicles to secrete estrogen, (positive feedback);
- low levels of estrogen initially inhibit FSH (and LH) secretion;
- rapid increase in estrogen stimulates FSH / LH production, (positive feedback);
- estrogen also starts to repair / thicken endometrium / uterine lining;
- LH stimulates ovulation;
- LH causes follicle to produce less estrogen (negative feedback) / more progesterone (positive feedback);
- LH stimulates follicle to become corpus luteum;
- corpus luteum secretes (more estrogen and) large level of progesterone (positive feedback);
- estrogen and / or progesterone stimulate thickening of endometrium / uterus lining;
- estrogen and / or progesterone inhibit FSH and LH secretion (by negative feedback);
- estrogen and / or progesterone levels fall after day 21-24 if no embryo / fertilization;
- lower concentrations of estrogen and / or progesterone allow disintegration of endometrium / menstruation occurs;
- FSH secretion begins a new cycle; 8 max

Award [6 max] if only three hormones are explained.
7. (a) **Award [1]** for each of the following clearly drawn and labelled correctly.

- a double layer of lipid / phospholipid molecules - with hydrophilic heads and hydrophobic tails;
- an integral protein - passing completely through the lipid bilayer;
- a peripheral protein - shown on the surface and not penetrating the lipid bilayer;
- an integral protein with a pore passing through its entire length / a glycoprotein with the carbohydrate components shown / cholesterol as component in bilayer;  

(b) chlorophyll is composed of a number of pigments;
- absorb different colours of light;
- mainly red and blue absorbed;
- green light reflected;
- temperature increases rate;
- up to a point where enzymes denature;
- light intensity increases rate;
- up to a point where maximum absorbance can occur;
- carbon dioxide increases rate;
- up to a point where fixation is at a maximum;  

(c) **Krebs cycle:** [3 max]
- in matrix of mitochondrion;
- decarboxylation;
- oxidation / removal of hydrogen by NAD and FAD;
- substrate level phosphorylation;

**Electron transport chain:** [5 max]
- transfer of hydrogen to inner membrane carriers;
- hydrogen ion pumped across inner membrane;
- creates a concentration gradient;
- electron transferred between carriers;
- chemiosmosis;
- hydrogen ion passes down concentration gradient;
- through ATPase complex;
- oxygen is final acceptor forming water;  

(Plus up to [2] for quality)
8. goes against concentration gradient / from low concentration to high concentration; requires hydrolysis of ATP / requires energy from ATP; proteins in membrane utilized; specificity of carriers; 

*eg* Na\(^+\)-K\(^+\) pump / other suitable examples; may involve conformational change in carrier protein; moves ions / solutes; maintains chemical / electrical gradient; [5]

9. passive transport requires no energy; molecules move down a concentration gradient; water moves by osmosis; from lower solute concentration to higher solute concentration / high water concentration to low water; small uncharged molecules move by diffusion; between phospholipid molecules; charged molecules move by facilitated diffusion; requires a protein channel; [5]

10. *Award [1] per difference,*

*plant cells:*

- have cell walls, animal cells do not;
- have plastids / chloroplasts, animal cells do not;
- have a large central vacuole, animal cells do not;
- store starch, animal cells store glycogen;
- have plasmodesomata, animal cells do not;

*animal cells:*

- have centrioles, plant cells do not;
- have cholesterol in the cell membrane, plant cells do not;
- plant cells generally have a fixed shape / more regular whereas animal cells are more rounded; [6]
11. **lysosome**: hydrolysis / digestion / break down of materials (macromolecules);  
**Golgi Apparatus**: synthesis / sorting / transporting / secretion of cell products;  
**rough endoplasmic reticulum**: site of synthesis of proteins (to be secreted) / intracellular transport of polypeptides to Golgi Apparatus;  
**nucleus**: controls cell activities / mitosis / replication of DNA / transcription of DNA (to RNA) / directs protein synthesis;  
**mitochondrion**: (aerobic) respiration / generates ATP;  


12. hormone binding sites;  
enzymes;  
electron carriers;  
channels for (passive) transport;  
(pumps) for active transport;  
cell to cell recognition;  
receptors for neurotransmitters;  

(Remember, up to TWO “quality of construction” marks per essay)  

4 max

13. **phospholipid structure**  
hydrophobic tail / hydrophilic head;  
head made from glycerol and phosphate;  
tail made from two fatty acids;  
saturated / unsaturated fatty acid (in tail);  

**arrangement in membrane**  
phospholipids form a bilayer;  
heads face outside the membrane / tails face inside the membrane / hydrophobic interior / hydrophilic exterior of membrane;  

A suitable annotated diagram may incorporate all or many of the above points.  
Award [5 max] for a suitable diagram that is labeled correctly.  

phospholipids held together by hydrophobic interactions;  
phospholipids layers are stabilized by interaction of hydrophilic heads and surrounding water;  
phospholipids allow for membrane fluidity / flexibility;  
fluidity / flexibility helps membranes to be (functionally) stable;  
phospholipids with short fatty acids / unsaturated fatty acids are more fluid;  
fluidity is important in breaking and remaking membranes (e.g. endocytosis / exocytosis);  
phospholipids can move about / move horizontally / “flip flop” to increase fluidity;  
hydrophilic / hydrophobic layers restrict entry / exit of substances;  

(Plus up to [2] for quality)  

9 max
Topic 1 (Old Curriculum) Past Exam Questions

Extended Response SOLUTIONS

14. uses / requires energy / ATP;
go against concentration gradient / lower to higher concentration;
requires a protein in the cell membrane / pump / carrier protein (reject channel);
hydrolysis of ATP / ATP $\rightarrow$ ADP + phosphate;
involves a conformational change in the pump / protein / diagram to show this;

15. prophase showing spindle fibres;
prophase showing condensed chromatin;
prophase showing replicated chromosomes;
metaphase showing replicated chromosomes lining up at the equator;
anaphase showing chromatids moving to opposite poles;
telophase showing nucleus reforming;
telophase showing cytokinesis occurring;

The four diagrams must have the name of the phase, otherwise award [3 max].
The four stages must be included to receive [5]. If correct number of chromosomes is not shown award [4 max].

16. two divisions in meiosis, only one in mitosis;
meiosis results in haploid cells, mitosis in diploid cells;
crossing over only occurs in meiosis;
no S phase precedes meiosis II;
chromosome behaviour in meiosis II and mitosis is similar / chromosome behaviour in meiosis I and mitosis is different;
chiasmata only form during meiosis;

Do not accept number of cells produced - it is a result not a behaviour.