

2.3 TRANSPORT ACROSS CELL MEMBRANES 1 – MARK SCHEMES.

- (a) 1. Polysaccharide of α -glucose;
OR
polymer of α -glucose;
2. (Joined by) glycosidic bonds
OR
Branched structure;
- 2

- (b) 1. Hydrolysed (to glucose);
2. Glucose used in respiration;
 1. *Ignore 'Broken down'*
 2. *'Energy produced' disqualifies mp2*
- 2

- (c) 1. Membrane folded **so** increased / large surface area;
OR
Membrane has increased / large surface area **for** (fast) diffusion / facilitated diffusion / active transport / co-transport;
2. Large number of protein channels / carriers (in membrane) **for** facilitated diffusion;
3. Large number of protein carriers (in membrane) **for** active transport;
4. Large number of protein (channels / carriers in membrane) **for** co-transport;
 1. *Accept 'microvilli to increase surface area'*
 1. *Reject reference to villi.*
Note feature and function required for each marking point and reference to large / many / more.
List rule applies.
- 2 max

- (d) 3.3×10^{-5} **OR** 3.28×10^{-5} **OR** 3.281×10^{-5} ;
1 mark for
Evidence of 128 (cells)
Correct numerical calculation but not in standard form gains 1 mark
(0.00003281 **OR** 0.0000328 **OR** 0.000033);
Accept any number of significant figures as long as rounding correct (3.28125×10^{-5} scores 2 marks)
- 2
- [8]

Q2.

- (a) Diffusion
Automarker
- 1
- (b) 1. **Droplets** increase surface areas (for lipase / enzyme action);
2. (So) faster hydrolysis / digestion (of triglycerides / lipids);
3. **Micelles** carry fatty acids and glycerol / monoglycerides to / through membrane / to (intestinal

epithelial) cell;

1. *Context is important*
1. *Reject micelles increase surface area*
2. *Ignore 'breakdown'*
3. *Ignore 'small enough'*
3. *Accept description of membrane*
3. *Reject any movement through membrane proteins*

3

- (c) 1. Golgi (apparatus);
2. Modifies / processes triglycerides;
3. Combines triglycerides with proteins;
4. Packaged for release / exocytosis

OR

Forms vesicles;

Ignore 'processes and packages' unqualified

2. *Reject synthesises triglycerides*
3. *Accept 'forms / are lipoproteins'*

4

[8]

Q3.

- (a) (Simple) diffusion;

Reject: facilitated diffusion.

1

- (b) 1. Thin/small **so** short diffusion pathway;

Reject: thin membrane/wall/cells.

2. Flat/long/small/thin **so** large surface area to volume ratio/surface area : volume;

Accept: small volume to surface area ratio.

2

- (c) 1. High/50% saturation (with oxygen) below (pO_2 of) 0.2 kPa;

*Accept: fully saturated **or** above 50% saturation below 0.2kPa.*

Accept: any number between 0.08 and 0.2 kPa

2. (Oxygen) for respiration;

2

- (d) 1. Water potential higher in worm

OR

Lower water potential in seawater;

Accept: correct reference to water potential gradient if direction of water movement is given.

Accept: ψ for water potential.

2. Water leaves by osmosis (and worm dies);

Reject: worm/cells burst.

2

[7]

Q4.

(a) Dipeptidase/s;
Accept: membrane bound dipeptidase/s.

1

(b) 1. Endopeptidases hydrolyse internal (peptide bonds)
OR
Exopeptidases remove amino acids/hydrolyse (bonds) at end(s);
Accept: break for hydrolyse.
Accept: endopeptidases break (proteins) into shorter chains.
2. More ends or increase in surface area (for exopeptidases);

2

(c) 1. No/less ATP produced
OR
No active transport;
2. Sodium (ions) not moved (into/out of cell);
Accept: sodium (ions) increase in cell.
Accept: sodium (ions) cannot diffuse into cell.
3. No diffusion gradient for sodium (to move into cell with amino acid)
OR
No concentration gradient for sodium (to move into cell with amino acid);
Accept: converse for all three points.
Note: no active transport of sodium (ions) equals 2 marks.

3

[6]

Q5.

(a) 1. (Releases) toxins;
2. Kills cells / tissues.
2. Accept any reference to cell / tissue damage
Ignore infecting / invading cells

2

(b) 1. Water potential in (bacterial) cells higher (than in honey) / water potential in honey lower (than in bacterial cells);
Q candidates must express themselves clearly
1. Must be comparative e.g. high WP in cell and low WP in honey
2. Water leaves bacteria / cells by osmosis;
3. (Loss of water) stops (metabolic) reactions.
3. Needs a reason why lack of water kills the cell

3

[5]

Q6.

(a) 1. (Nerve impulse / depolarisation of membrane) causes Ca²⁺ channel (proteins) to open;
2. Ca²⁺ enter by (facilitated) diffusion;
3. Causes (synaptic) vesicles to fuse with (presynaptic) membrane;
Accept single reference to ions to cover 1 and 2

Penalise once for no reference to ions

1. *Reject carrier proteins*
3. *Reject ref to release of vesicles*
3. *Ignore vesicles bind to membrane (but accept merge with)*

3

- (b)
1. Myosin head attaches to actin **and** bends / performs powerstroke;
 2. (This) pulls mitochondria past / along the actin;
 3. Other / next myosin head attaches to actin (and bends / performs powerstroke);
 1. *Accept change shape / change angle*
 2. *Ignore pulls actin along*
 2. *Ignore refs to cytoskeleton*

Accept plural or singular statements

2 max

- (c)
1. (Mitochondria) supply (additional) ATP / energy;
 2. To move vesicles / for active transport of ions / for myosin to move past actin
- OR**
- Re-synthesis / reabsorption of neurotransmitter / named neurotransmitter;
1. *Reject produces energy*
 2. *Ignore ref. to ATP for opening calcium ion channels/making vesicles fuse with membrane*

2

[7]

Q7.

(a)

Transport through a channel protein

Q

1

Transport of small, non-polar molecules

P

1

Transport of glucose with sodium ions

S

1

- (b)
1. (Y is) an enzyme/has active site/forms ES complex;
Accept catalyst
 2. That makes cellulose/attaches substrate to cellulose/joins β glucose;
- OR**
3. Makes cellulose/forms glycosidic bonds;
 4. From β glucose;
- Mark in pairs (1&2 or 3&4)*

2

- (c) Cell wall forms outside cell-surface membrane/has cellulose on it (on the outside);

1

(d) (Tick in box next to) Hydrogen;

1

[7]

Q8.

(a) 1. In phospholipid, one fatty acid replaced by a phosphate;
Ignore references to saturated and unsaturated

Accept $\text{Pi}/\text{PO}_4^{3-} / \text{P}$

Reject P/Phosphorus

Accept annotated diagrams

1

(b) 1. Add ethanol, then add water;

Reject ethanal/ethonal

Accept 'Alcohol/named alcohol'

2. White (emulsion shows lipid);

Accept milky – Ignore 'cloudy'

Sequence must be correct

If heated then DQ point 1

Reject precipitate

2

(c) Saturated single/no double bonds (between carbons)

OR

Unsaturated has (at least one) double bond (between carbons);

Accept hydrocarbon chain/R group for 'between carbons' for either

Accept Sat = max number of H atoms bound

'It' refers to saturated

1

(d) 1. (Fat substitute) is a different/wrong shape/not complementary;

OR

Bond between glycerol/fatty acid and propylene glycol different (to that between glycerol and fatty acid)/no ester bond;

2. Unable to fit/bind to (active site of) lipase/no ES complex formed;

If wrong bond name given (e.g. peptide/glycosidic), then penalise once

2

(e) It is hydrophilic/is polar/is too large/is too big;

Ignore 'Is not lipid soluble'

1

[7]

Q9.

(a) 1. (Overall) outward pressure of 3.2 kPa;
2. Forces small molecules out of capillary.

2

(b) Loss of water / loss of fluid / friction (against capillary lining).

- (c) 1. High blood pressure = high hydrostatic pressure;
 2. Increases outward pressure from (arterial) end of capillary / reduces inward pressure at (venule) end of capillary;
 3. (So) more tissue fluid formed / less tissue fluid is reabsorbed.

Allow lymph system not able to drain tissues fast enough

3

- (d) 1. Water has left the capillary;
 2. Proteins (in blood) too large to leave capillary;
 3. Increasing / giving higher concentration of blood proteins (and thus wp).

3

[9]

Q10.

- (a) (i) Diffusion;

Ignore references to structures, membrane components etc

Allow simple diffusion

Reject facilitated diffusion

1

- (ii) 1. (Thin / flat body) so short distance for diffusion / short diffusion pathway;

Ignore references to membrane, wall, body surface

2. (Thin / flat body so) large surface area to volume ratio;

'It' refers to flatworm's body

2

- (b) (i) A group of tissues;

Ignore references to function Group = more than one

1

- (ii) 1. (Carbon dioxide enters) via stomata;

Reject stroma

2. (Stomata opened by) guard cells;

3. Diffuses through air spaces;

Allow concentration gradient. Reject along gradient unless direction made clear

4. Down diffusion gradient;

3 max

[7]

Q11.

- (a) 1. **A:** phospholipid (layer);

1. Reject hydrophobic / hydrophilic phospholipid

2. **B:** pore / channel / pump / carrier / transmembrane / intrinsic / transport protein;

2. Ignore unqualified reference to protein

(b) (i) Condensation (reaction);

1

(ii) Organelle named; Function in protein production / secretion;

Function must be for organelle named

Incorrect organelle = 0

eg

1. Golgi (apparatus);

1. Accept smooth endoplasmic reticulum

2. Package / process proteins;

OR

3. Rough endoplasmic reticulum / ribosomes;

3. Accept alternative correct functions of rough endoplasmic reticulum. ER / RER is insufficient

3. Accept folding polypeptide / protein

4. Make polypeptide / protein / forming peptide bonds;

OR

5. Mitochondria;

6. Release of energy / make ATP;

6. Reject produce / make energy

6. Accept produce energy in the form of ATP

OR

7. Vesicles;

8. Secretion / transport of protein;

2

[5]

Q12.

(a) 1. Flatten / moves down;

1. Ignore: additional information about rib movements

2. (Diaphragm muscle) contracts;

2

(b) 1. Diaphragm contracts / moves down / flattens;

Ignore refs to rib movement

2. Increases volume (of thorax) and decrease in pressure;

2. Accept pressure lower than atmospheric pressure

3. Air moves from high to lower pressure / down pressure gradient;

3. *Reject: by diffusion*

3

- (c) 1. Diffusion;
Accept down diffusion gradient
2. Across (alveoli) epithelium / (capillary) endothelium;
2. Accept: capillary epithelium / squamous cell

2 max

[7]

Q13.

- (a) 1. Bilayer;
Accept double layer
Accept drawing which shows bilayer
2. Hydrophobic / fatty acid / lipid (tails) to inside;
3. Polar / phosphate group / hydrophilic (head) to outside;
2. & 3. need labels
2. & 3. accept water loving or hating

2 max

- (b) (i) 1. (Rough endoplasmic reticulum has) ribosomes;
accept "contains / stores"
2. To make protein (which an enzyme is);
Accept amino acids joined together / (poly)peptide
Reject makes amino acids
Ignore glycoprotein

2

- (ii) (Golgi apparatus) modifies (protein)

OR

packages / put into (Golgi) vesicles

OR

transport to cell surface / vacuole;
Accept protein has sugar added
Reject protein synthesis
Accept lysosome formation

1

[5]

Q14.

- (a) (i) Made of (different) tissues / more than one tissue;
- (ii) 1. (Muscle) contracts;
Assume that "they" or "it" = muscle

1

2. (Arteriole) narrows / constricts / reduces size of lumen / vessel / vasoconstriction;
Ignore: references to pressure
Q Correct context for muscle contracts, vessel constricts 2
- (b) (i) Short diffusion distance / pathway;
Accept: thin diffusion pathway 1
- (ii) (More) time for exchange / diffusion (of substances);
Accept: example of more time for specific substance to be exchanged 1
- (c) 1. Water potential (in capillary) not as low / is higher / less negative / water potential gradient is reduced;
Accept: 'blood or plasma' instead of 'capillary'
2. Less / no water removed (into capillary);
Accept converse: water remains in the tissue
3. By osmosis (into capillary);
Q Marking points 2. and 3. must be in the context of movement into the capillary
Neutral: reference to more tissue fluid being formed as in the question stem
Neutral: reference to lymphatic drainage 3

[8]

Q15.

- (a) (i) no cell wall / only has (plasma) membrane; 1
- (ii) has capsule / slime layer; 1
- (b) correct approach which makes use of scalebar; *ignore* reference to units. 1
- (c) cellulose / starch / amylose / amylopectin; 1
- (d) (i) water potential lower / more negative in cell;
 (water enters by) osmosis; 2
- (ii) plant cell wall made of a different substance / cellulose / penicillin does not affect cellulose; 1

[7]

Q16.

- (a) Electron microscope has higher resolution (than optical microscope).

- 1
- (b) Cytoplasm of red blood cell filled with haemoglobin. 1
- (c) 1. Membrane has phospholipid bilayer;
2. Stain binds to phosphate / glycerol;
3. On inside and outside of membrane.
Accept phospholipid head / protein 3
- (d) 1. Carrier / channel protein;
2. (Protein) specific / complementary to substance;
3. Substance moves down concentration gradient;
Allow down electrochemical gradient
Reject 'along' concentration gradient 3

[8]

Q17.

- (a) Digestion / hydrolysis / breakdown of a disaccharide into monosaccharides;
OR
(glucose and galactose form lactose) glucose is a monosaccharide; max 1
- (b) (i) Dipeptidase / disaccharidase / named disaccharidase; 1
- (ii) Enzymes not lost (with gut contents) / more effective absorption
of products formed by these enzymes; 1
- (c) No ATP formed / no energy released by respiration;
[reject "making" energy]
- Link ATP to active transport (of galactose) into cells; 2

[5]

Q18.

- (a) *two of the following:*
form(water) impermeable barrier to water-soluble substances / selectively
permeable / allows non-polar molecules to pass through;
allows cell to maintain different concentrations either side;
makes membranes self-sealing / able to fuse with other
membranes / able to form
vesicles / gives flexibility / fluidity; 2 max
- (b) (surface / extrinsic protein) for cell recognition / binding to
hormones / identification 1

- (c) (i) involves carrier / transmembrane / transport proteins;
(*reject channel proteins*) 1
- (ii) requires energy / requires use of ATP / moves
substances / ions / molecules against a concentration gradient; 1
- (iii) the curve levels off above a certain external concentration of
substance; as channel proteins are saturated with molecules
(and no more can be carried); 2
- [7]**

Q19.

- (a) Transports Na⁺ and K⁺ ;
By active transport / pump / against concentration gradient;
Restores ion balance after an action potential;
[*reject K⁺ out and Na⁺ in*] 2
- (b) (i) each protein has a specific tertiary structure / shape;
because the ions have different sizes / shape / charge;
[*reject receptors binding*] 2
- (ii) fewer protein B molecules, which transport sodium ions / more
protein A molecules, which transport potassium ions; 1
- [5]**

Q20.

- (a) Large surface area to volume ratio;
For diffusion;
OR
Flat / thin;
So oxygen can reach all haemoglobin / centre rapidly / short pathway; max 2
- (b) (i) Partially permeable / allows water through but not sucrose;
Accept semi-permeable / selectively permeable. 1
- (ii) Phospholipid (in membrane) / bilayer dissolved / broken down;
Allows haemoglobin / contents to leak out; 2
- [5]**

Q21.

- (a) (Blood) plasma; 1
- (b) More / larger proteins / less urea / carbon dioxide / more glucose / amino acids
/ fatty acids / oxygen / high(hydrostatic) pressure;
Q Reference to blood cells / water potential = neutral

Q No Protein should not be credited

1

(c) (i) Contracts;

Q Do not accept pumping of heart / heart beating

1

(ii) Loss of fluid / volume;

Friction / resistance (of capillary wall);

Q Reference to a narrow lumen is not sufficient to gain a mark unless friction or resistance is mentioned.

1 max

(d) Water potential (in capillary) not as low / is higher / less negative / water potential gradient is reduced;

More tissue fluid formed (at arteriole end);

Less / no water absorbed (into blood capillary) by osmosis; (into blood capillary);

Q The last two marking points must be in context of movement into the blood capillary

3

[7]

Q22.

(i) Lack of ATP;

Pump = active transport / requires energy / ATP provides energy / transport is up concentration gradient;

2

(ii) Concentration of Na⁺ inside cell no longer less than concentration in gut lumen / no longer a concentration gradient;

No (facilitated) diffusion of NA⁺ ions possible / amino acid absorption requires diffusion of Na⁺ ions into cell;

2

(iii) Diffusion / facilitated diffusion;

1

[5]

Q23.

(a) antibiotic has diffused / spread / moved into agar; killed / inhibited bacteria;

2

(b) largest clear area / inhibition zone / killed the most bacteria;

1

(c) disrupts cell wall / prevents cell wall synthesis; stops DNA replication;

2

[5]

Q24.

- (a) 1. Polar molecule;
2. Acts as a (universal) solvent;

OR

3. (Universal) solvent;
4. (Metabolic) reactions occur faster in solution;

OR

5. Reactive;
6. Takes place in hydrolysis / condensation / named reaction;
Polar molecule so acts as (universal) solvent so (metabolic reactions are faster = 3 marks

4

- (b) Name of ion;

Correct function within cell;

Ions other than sodium in specification are H^+ , Fe^{2+} and PO_4^{3-} but accept any correct ion (other than sodium) plus relevant function = 2.

Allow ion to be named in words but not as element, e.g, iron ion but not iron.

2

- (c) 1. Comparison: both move down concentration gradient;
2. Comparison: both move through (protein) channels in membrane;
Accept aquaporins (for water) and ion channels
3. Contrast: ions can move against a concentration gradient by active transport

3

[9]

Q25.

- (a) beating / pumping of heart / contraction of ventricles / heart;

1

- (b) (at arterial end) hydrostatic pressure / blood pressure;
greater than pressure of water potential gradient / greater than osmotic uptake;

2

- (c) removed by lymphatic system / lymph; returned to blood;

2

- (d) less protein in blood;
water potential gradient is lower (less -ve / higher ψ).

2

[7]

Q26.

- (a) Active transport against / facilitated down with concentration gradient;
Accept answers in terms of water potentials

Active transport uses ATP/energy, /facilitated doesn't;
Reject along/across gradient

Active uses carrier (proteins), / facilitated (often) uses channel (proteins);
2 max

- (b) Lipid/fatty acid part of membrane is non-polar/hydrophobic;
Accept lipid/fatty acid bilayer

Oxygen and carbon dioxide small/ non-polar (molecules);

Oxygen/carbon dioxide can diffuse through/dissolve in/
get between molecules in this layer;

Down a concentration gradient;
2 max

- (c) Brings more oxygen/removes carbon dioxide;

Maintains diffusion/concentration gradients;

Between alveoli and blood/capillaries;
Reject references to surface area

2 max

[6]

Q27.

- (a) Fluid = molecules move around;
Mosaic = proteins floating among phospholipids/not just phospholipids/
other molecules in it/made of different sorts of molecules;

Accept liquid

2

- (b) Any two from
Enzymes;
Antigens/cell recognition/cell markers;
Receptors;
Carriers;
Channels;

Any 2

Accept active transport and facilitated diffusion for 1 mark each

2 max

- (c) Active transport;
Calcium ions move against a concentration gradient/calcium ion concentration
in solution is (much) higher than concentration inside cells;

2

[6]

Q28.

- (a) cell has lower water potential than external medium;
so, water enters by osmosis; 2
- (b) (i) active transport;
by specific carrier proteins / pumps; 2
- (ii) sodium ions transported more into vacuole (than to outside);
because more sodium carrier proteins / pumps in vacuole membrane;
or
vacuole membrane less permeable to sodium ions / allows slower
sodium ion diffusion (back out);
membrane has fewer sodium channels;

2 max

[6]

Q29.

- (a) (i) presence of -COOH group; 1
- (ii) similar structure so fit same protein / receptors; 1
- (b) 2,4-D adds to effect of IAA (already present) / affects all cells;
stimulates growth in parts other than growing points / stimulates
uncontrolled growth / makes walls of cells stretch too much /
makes growth outstrip nutrient availability; 2

[4]

Q30.

- (a) feature and adaption; for example
- 1 phospholipid bilayer (as a barrier);
2 forms a barrier to water soluble / charged substances /
allows non-polar substances to pass
- OR
- maintains a different environment on each side / compartmentalisation;
- 3 bilayer is fluid;
4 can bend to take up different shapes for phagocytosis /
form vesicles / self repair;
5 channel proteins (through the bilayer) / intrinsic protein;
6 let water soluble / charged substances through / facilitated diffusion;
7 carrier proteins (through the bilayer);
8 allow facilitated diffusion / active transport;
9 surface proteins / extrinsic proteins, glycoproteins / glycolipids;
10 cell recognition / act as antigens / receptors;
11 cholesterol;
12 regulates fluidity / increases stability;

6 max

principle mark (only for 5, 6, 7, 8)
proteins transport material across the membrane

3 features max

- (b) curve description:
 1 Curve goes down when the poison is added and rises when ATP added;

1

explanation:

- 2 Ion movement is by active transport;
 3 ATP / energy needed for active transport;
 4 respiration provides ATP / energy;
 5 poison inhibits / stops respiration / ATP production;

3 max

[10]

Q31.

- (a) rate of photosynthesis increased;
 normal atmospheric concentration a limiting factor / more / faster production of biomass or sugars / more products of photosynthesis transported to fruits;

2

- (b) (increased temperature) increases rate of respiration;
 rate of photosynthesis too low to replace respiratory loss

2

- (c) lower water potential of nutrient solution;
 less water absorbed into roots (by osmosis);
(not: water lost from roots)

2

[6]

Q32.

General Principles for marking the Essay:

Four skill areas will be marked: scientific content, breadth of knowledge, relevance and quality of language. The following descriptors will form a basis for marking.

Scientific Content (maximum 16 marks)

Category	Mark	Descriptor
Good	16	Most of the material reflects a comprehensive understanding of the principles involved and a knowledge of factual detail fully in keeping with a programme of A-level study. Some material, however, may be a little superficial. Material is accurate and free from fundamental errors but there may be minor errors which detract from the overall accuracy.
	14	
	12	
Average	10	Some of the content is of an appropriate depth, reflecting the depth of treatment expected from a programme of A-level study. Generally accurate with few, if any, fundamental errors. Shows a sound understanding of the key
	8	

	6	principles involved.
Poor	4 2 0	Material presented is largely superficial and fails to reflect the depth of treatment expected from a programme of A-level study. If greater depth of knowledge is demonstrated, then there are many fundamental errors.

Breadth of Knowledge (maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most areas that might realistically be covered on an A-level course of study.
2	A number of aspects covered but a lack of balance. Some topics essential to an understanding at this level not covered.
1	Unbalanced account with all or almost all material based on a single aspect.
0	Material entirely irrelevant or too limited in quantity to judge.

Relevance (maximum 3 marks)

Mark	Descriptor
3	All material presented is clearly relevant to the title. Allowance should be made for judicious use of introductory material.
2	Material generally selected in support of title but some of the main content of the essay is of only marginal relevance.
1	Some attempt made to relate material to the title but considerable amounts largely irrelevant.
0	Material entirely irrelevant or too limited in quantity to judge.

Quality of language (maximum 3 marks)

Mark	Descriptor
3	Material is logically presented in clear, scientific English. Technical terminology has been used effectively and accurately throughout.
2	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate.
1	The essay is generally poorly constructed and often fails to use an appropriate scientific style and terminology to express ideas.
0	Material entirely irrelevant or too limited in quantity to judge.

[25]

Guidelines for marking the essay

Introduction

The essay is intended for the assessment of AO4 (Synthesis of knowledge, understanding and skills) and Quality of Written Communication (Sections 6.4 and 6.5 in the specification). Examiners are looking for

- evidence of knowledge and understanding at a depth appropriate to A level
- selection of relevant knowledge and understanding from different areas of the specification
- coverage of the main concepts and principles that might be reasonably be

expected in relation to the essay title

- connection of concepts, principles and other information from different areas in response to the essay title
- construction of an account that forms a coherent response
- clear and logical expression, using accurate specialist vocabulary appropriate to A level

Assessing Scientific Content

Maximum 16 marks.

Descriptors are divided into 3 categories:

Good (16, 14, 12), Average (10, 8, 6) and Poor (4, 2, 0).

Only even scores can be awarded, i.e. not 15, 13, etc.

Examiners need first to decide into which category an essay comes.

A good essay

- includes a level of detail that could be expected from a comprehensive knowledge and understanding of relevant parts of the specification
- maintains appropriate depth and accuracy throughout
- avoids fundamental errors
- covers a majority of the main areas that might be expected from the essay title (These areas will be indicated in the mark scheme). (Occasionally a candidate may tackle an essay in an original or unconventional way. Such essays may be biased in a particular way, but where a high level of understanding is shown a high mark may be justified.)
- demonstrates clearly the links between principles and concepts from different areas.

Note that it is not expected that an essay must be 'perfect' or exceptionally long in order to gain maximum marks, bearing in mind the limitations on time and the pressure arising from exam conditions.

An average essay

- should include material that might be expected of C / D / E grade candidates
- is likely to have less detail and be more patchy in the depth to which areas are covered, and to omit several relevant areas
- is likely to include some errors and misunderstandings, but should have few fundamental errors
- is likely to include mainly more superficial and less explicit connections

A poor essay

- is largely below the standard expected of a grade E candidate
- shows limited knowledge and understanding of the topic

- is likely to cover only a limited number of relevant areas and may be relatively short
- is likely to provide superficial treatment of connections
- includes several errors, including some major ones

Having decided on the basic category, examiners may award the median mark, or the ones above or below the median according to whether the candidate exceeds the requirements or does not quite meet them.

Marking the essay

In marking scientific content, letters in the margin show each key area covered; these are used to assess the breadth of criteria. A single tick is used to indicate accurate coverage of each significant area, and a double tick to emphasise 'good depth of content.' Errors are indicated with a cross. A squiggly line in the margin is used to highlight irrelevance and 'Q' to highlight poor use of terminology, unclear grammar and inappropriate style.

Specific guidance for assessing Scientific Content and Breadth of Knowledge in Essays

The following provides guidance about topics which might be included in the essays. It is not an exclusive list; the assessment of scientific content does not place restrictions on topics that candidates might refer to, provided they are

- relevant;
- at an appropriate depth for A level and
- accurate.

It is not expected that candidates would refer to all, or even most, of the topics to gain a top mark; the list represents the variety of approaches commonly encountered in the assessment to the essays. In both essays, topics either from the option modules or beyond the scope of the specification should also given credit where appropriate.

The process of osmosis and its importance to living organisms

(1) definition (D)

(2) effects on cells (C)

turgity and support
 plasmolysis (idea)
 lysis

(3) importance in animals (A)

role in relationship between plasma and tissue fluid
 role in medulla of kidney
 reabsorption in gut
sweat production neutral

(4) importance in plants (P)

role in movement of water from soil to leaves in plants

role in mass flow hypothesis for movement in plants

Breadth of knowledge

3 marks	reference to all 4 areas
2 marks	definition + 2 other areas
1 mark	any 2 areas

(b) Energy transfers which take place in living organisms

- (1) ATP (A)
synthesis from ADP and P
role as an energy source
- (2) photosynthesis (P)
excitation of electrons
generation of ATP and reduced NADP
photolysis
reduction of glycerate phosphate to carbohydrate
structure of chloroplast in relation to energy transfers
- (3) respiration (R)
net gain of ATP in glycolysis
production of ATP in Krebs cycle
synthesis of ATP associated with electron transfer chain
ATP production in anaerobic respiration
structure of mitochondrion in relation to energy transfers
- (4) uses of energy in biological processes (B)

active transport
muscle contraction
nerve transmission
synthesis
translocation
kidney function
nitrogen fixation
receptors

Breadth of knowledge

3 marks	reference to all 4 areas
2 marks	ATP + 2 other areas
1 mark	any 2 areas

Q33.

- (a) Does not have the resolution / cannot distinguish between points this close together;
As light has longer wavelength;
The key ideas in marking this part of the question are resolution and wavelength. 2
- (b) Lipid soluble / small / non-polar / not charged; 1
- (c) (i) Concentration of sodium ions (outside cell);
As concentration / independent variable increases so does
the rate of diffusion; 2

- (ii) Sodium ions are passing through the channels / pores at their maximum rate;
Rate is limited by the number of sodium channels / another limiting factor;

2

[7]

