# Membranes

## Mark Scheme 2

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|---|---|
| **Level** | International A Level |
| **Subject** | Biology |
| **Exam Board** | CIE |
| **Topic** | Cell Membranes and Transport |
| **Sub Topic** | Membranes |
| **Booklet** | Theory |
| **Paper Type** | Mark Scheme 2 |

**Time Allowed :** **54 minutes**

**Score :** **/ 45**

**Percentage :** **/100**

**Grade Boundaries:**

| A* | A | B | C | D | E | U |
|---|---|---|---|---|---|---|
| >85% | '77.5% | 70% | 62.5% | 57.5% | 45% | <45% |

**1** **(a)** **(i)** calcium ions are, water soluble / charged / not, fat / lipid, soluble / hydrophilic / ionic **;** **A** not oil soluble
phospholipid bilayer / AW, is hydrophobic / AW **;** [2]

**(ii)** active transport / active uptake **;** [1]

(calcium ions) moved against their concentration gradient **;**
ref. to, carrier protein / transport protein / pump protein **;** **ignore** ion pump
**R** channel protein
ref. to calcium ions combine with binding site **;**
carrier protein, changes shape / conformational change **;**
ref. to ATP **;** [2 max]

**(b)** bacteria / antigen / epitope, combine(s) with / attach to/ recognition by, receptor **;**
antibody on bacteria combines with receptor **;**
opsonisation / opsonisation described **;** e.g. facilitates phagocytosis
ref. to constant region **;**

membrane infolds / invaginates / envelops / engulfs / enclose / AW **;**
*accept answers without 'membrane' where implied previously / later*
membrane fuses **;**
to form, vacuole / vesicle / phagosome (enclosing bacteria) **;** [3 max]

**(c)** lysosomes fuse with, vacuole / vesicle / phagosome **;**
**A** form secondary lysosomes
lysosomes contain, enzymes / named digestive enzyme **;**
(catalyse) hydrolysis / digestion **;** **A** breakdown
(digests / breaks down) protein / murein (or peptidoglycan) / carbohydrate / lipid / phospholipid / nucleic acid / DNA / RNA **;**
named bond **;** e.g. peptide, glycosidic, ester, phosphodiester [4 max]

**[Total: 12]**

2 **(a (i)** bracket extends across whole bilayer ; [1]

**(ii)** *fluid*
phospholipids move (within their monolayer) / proteins, move / float ;
**A** phospholipids are liquid
*mosaic*
proteins, scattered / dispersed, within, phospholipids / bilayer ;
**R** membrane unqualified [2]

**(iii)** both made of, protein / polypeptide(s) / amino acids ;
*both have*
disulphide bond ;
antigen binding site ;
variable region ;
constant region ; **A** non-variable max]

**(b)** *helper cells*
secrete / release / produce, cytokines / lymphokines / hormones ;
to stimulate B cells to, divide / develop into plasma cells ;
(which) produce antibodies ;
stimulate macrophages to carry out phagocytosis ;

*cytotoxic / killer T cells*
seek out / find / bind to, (foreign) antigens, on host cells / pathogens ;
destroy, virally infected host cells / intracellular parasites / viruses ;
attach to surface of cells / 'punch holes' into cells / disrupt cell surface (plasma) membrane;
(release) toxic substances / hydrogen peroxide (into cells) / interferons ;
**R** enzymes [4 max]

**(c)** control of entry and exit of substances ;
barrier to, polar molecules / water soluble molecules ;
adhesion ;
idea of retaining, large molecules / cell contents;
allow substances across, passively / by diffusion ;
ref to channel proteins ; **A** pore *allow transport protein once*
move substances through carrier proteins ;
active transport ;
ref to facilitated diffusion ;
endocytosis / exocytosis / phagocytosis / pinocytosis ;
recognise, hormones / neurotransmitters / chemical signals ;
sites of chemical reactions / sites for enzymes ; [3 max]

**[Total: 12]**

| Question | Expected Answers | Marks |
|---|---|---|
| 3 **(a)** | *max 3 for glycoproteins and carrier proteins combined* | |

*glycoproteins*
receptors / receptor molecules;
for hormones / neurotransmitters / named hormone / neurotransmitter (e.g. insulin, acetyl choline, noradrenaline);
idea of (cell surface) antigens / (cell surface) markers / cell recognition / cell adhesion;
help to <u>stabilise</u> membrane structure / forms H bonds with water molecules;

*carrier proteins*
allow named substance (e.g. glucose / amino acids) / polar substance / ion(s) / hydrophilic / water soluble substance (to pass through membrane);
(ref) against concentration gradient / active transport;
energy / ATP (req for transport);
(and) facilitated diffusion / faster than simple diffusion (for ions / polar molecules);

*cholesterol*
maintains / regulates fluidity of membrane / prevents membrane being too rigid or fluid / mechanical stability (qualified) / prevent ions / polar / water soluble / named molecule, passing / leaking through membrane;

**max 4**

**(b)** *max 3 for each of the following*

**A**
active transport;
carrier / transport <u>protein</u>;
(pumped) against concentration gradient / low to high conc;
using energy / ATP;
detail (eg binding to specific receptor sites / idea of conformational change);

**B**
diffusion; R. facilitated difffusion
ATP not used; R. energy not needed
through lipid bilayer / phospholipids / hydrophobic region;

**max 4**

| Question | Expected Answers | Marks |
|---|---|---|
| 3 **(c)** | (bacteria) adhere / stick / bind / attach , to surface (of phagocyte);<br>ref to receptors / receptor proteins (on phagocytes) / (detect) bacteria 'marked' by antibodies / opsonins;<br>ref to pseudopodia / extensions of cytoplasm; R. invagination unqualified<br>engulfed / enveloped / endocytosis / phagocytosis, to form <u>vacuole</u> / <u>vesicle</u> / <u>phagosome</u>;<br>A. marking points from <u>annotated</u> diagram(s) | **max 2** |
| **(d)** | contain (hydro)lytic / digestive / named enzymes / digestion of <u>bacteria</u> / <u>pathogens</u>; | **1** |
| | | **[Total 11]** |

4 **(a** phospholipid (and protein) molecules, move about / diffuse / AW **;**
protein (molecules), scattered / AW **;** **A** different proteins present [2]

**(b)** *similarity to max 1*
(contains) phospholipid (bilayer)**;** **A** detail of orientation of phospholipid
**A** lipid bilayer
(contains) protein **;**

*difference (look for ora)*
(Davson Danielli) layer(s) of protein / protein only on outside **;**
(fluid mosaic) ref. to proteins, in different locations discrete / different types / named or described **;**
(fluid mosaic) presence of cholesterol (molecules) **;** [max 2]

**(c)** **1** requirement for, energy / ATP **; R** ATP energy
**2** uses, carrier / transport, protein **; A** pump
**3** conformational change (of carrier protein) **;** AW
**4** moving against a concentration gradient **; A** low to high concentration
**5** specific, binding site **; A** ref. to specificity to substance moved across [max 3]

*to max 2*
**(d)** **1** loss of, tertiary structure / quaternary structure / secondary structure **;**
**A** loss of shape of active site *in correct context*
**2** loss of globular, shape / structure / form **;**
**3** breakage of, ionic / hydrogen / hydrophobic, bonds / interactions **;**

*to max 2*
**4** loss of function of (membrane) proteins **;**
**5/6** detail **; ;**
e.g. transport of, polar molecules / ions, impaired AW
loss of cell to cell adhesion
unable to receive cell signals
loss of enzyme function
**7** ref. to membranes, become leaky / lose partially permeable nature **;**
**A** cannot regulate, entry / exit, substances
**8** disrupt interaction between protein and phospholipid bilayer / described **;** [max 3]

**[Total: 10]**