

My Question Paper

1. • Doxorubicin (DOX) and idarubicin (IDA) are antibiotics.
- They are widely used in human cancer treatment.
- DOX causes rapid changes in red blood cell membranes following injection.
- These changes are
- decreased fluidity of the hydrophobic parts of the lipid bilayer
 - the membrane proteins change shape.
- IDA is considered to be less toxic to cancer patients than DOX.

(a) (i) Explain what is meant by the term 'lipid bilayer'.

[1]

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(ii) Name the 'hydrophobic parts' referred to in the information above.

[1]

.....

(iii) State **two** functions of membrane proteins.

[2]

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(b) Use the information above to suggest why the changes in red blood cell membranes caused by **DOX** make it more toxic than **IDA**.

[2]

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(c) These drugs are used in cancer treatment. Explain briefly what is meant by the term cancer.

[2]

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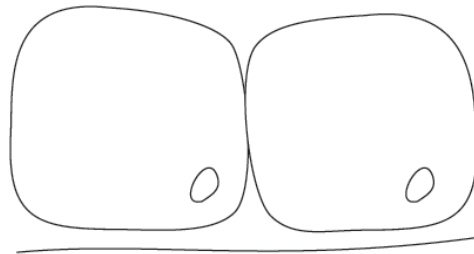
Total

[8]

2. (a) Samples of epithelial tissue were examined using a light microscope. Drawings of cells from these tissues are shown below. Identify the type of epithelial tissue shown, and suggest from where in the body the samples were taken.

(i)

[2]

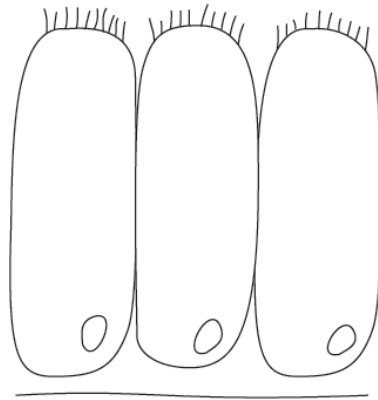


Tissue type

Where found in body

(ii)

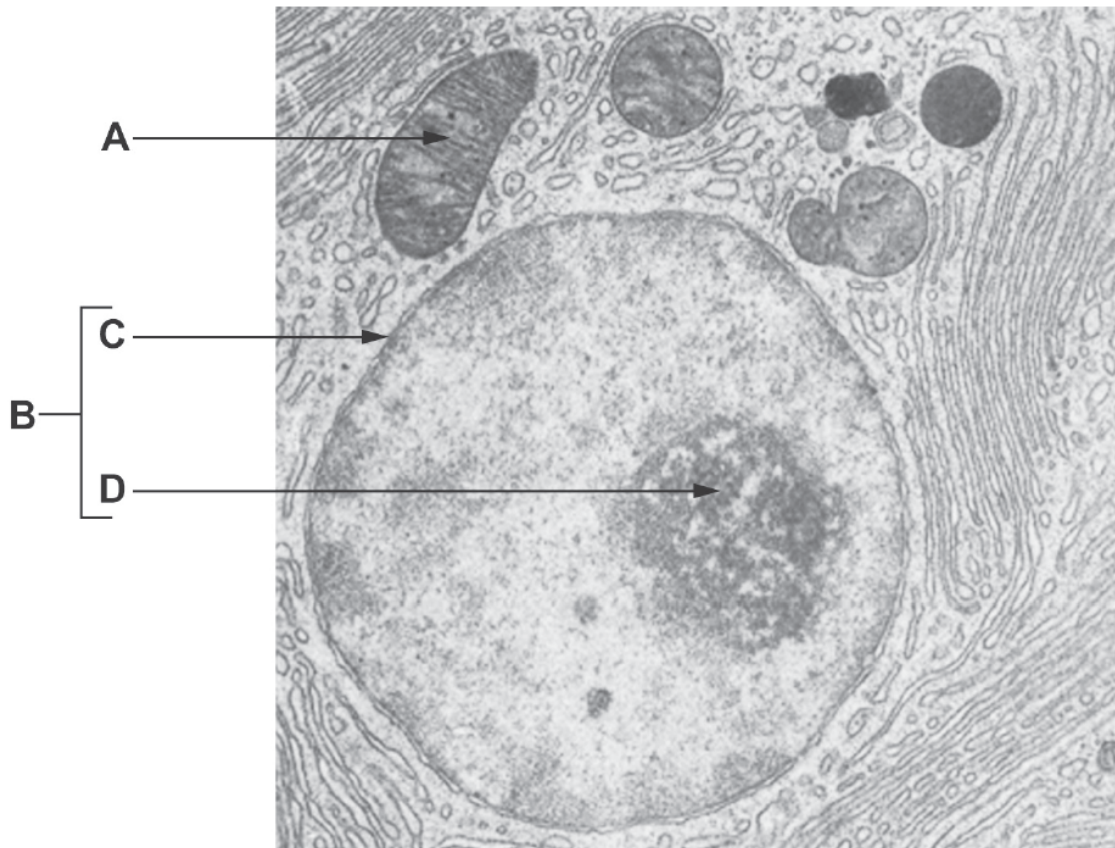
[2]



Tissue type

Where found in body

The electron micrograph below shows part of a typical animal cell.



(b) Complete the table below by naming the structures and organelles shown in the electron micrograph above, and describing their functions.

[4]

Letter	Organelle / Structure	Function
B	nucleus	
C	nuclear pores	
D		

(c) The nucleus has pores in the envelope that surrounds it, whereas organelle **A** does not. Describe **one** other difference between the membranes that surround organelle **A** and those that surround the nucleus.

[1]

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(d) Describe **two** differences between the ribosomes found in animal cells and those found in prokaryotic cells.

[2]

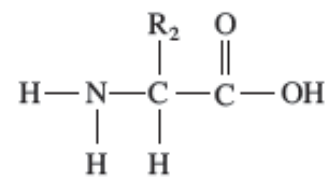
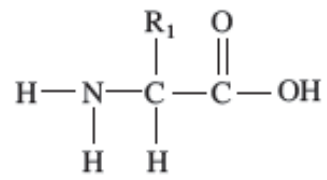
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3. The diagram below shows two molecules which are sub-units of proteins.



(a) (i) Complete the diagram above to show how a reaction takes place to join the two molecules.

[3]

(ii) Name the type of reaction involved.

[1]

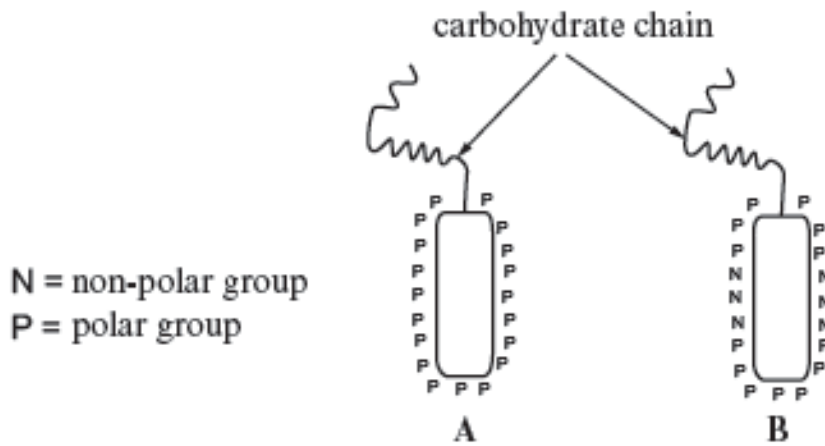
(iii) Name the type of bond formed.

[1]

(b) (i) Why is the model of the structure of biological membranes described as 'fluid mosaic'?

[2]

The diagrams below represent two glycoprotein molecules found in the plasma membranes of mammalian cells.



(ii) Which of the molecules A or B will form an intrinsic protein in the plasma membrane?

[1]

Molecule

(iii) Draw a labelled diagram of the plasma membrane using the diagrams above to show the correct positioning of glycoproteins A and B.

[2]

(iv) Give one function of the carbohydrate chains on the glycoproteins.

[1]

.....

(c) Some diseases are caused by abnormal proteins called prions. Some prions have a higher proportion of β ; pleated sheet in place of the normal helix structure.

(i) What level of protein structure is described by the terms helix and β ; pleated sheet?

[1]

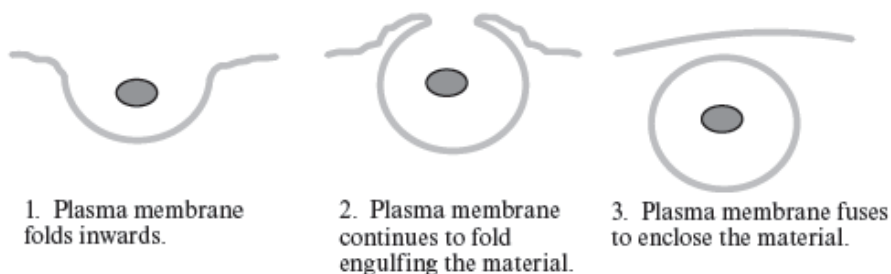
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(ii) Which organelles are involved in synthesising proteins?

[1]

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(d) The following diagram shows one way that prions may pass into cells.



(i) Name the process shown in the diagram above.

[1]

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(ii) Name two other ways in which substances might pass into the cell.

[2]

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.....

4. Answer one of the following questions.
Any diagrams included in your answers must be fully annotated.

Either, (a) Using examples to illustrate your answer, describe how the structures of polysaccharides are related to their functions.

[10]

Or (b) Globular proteins are an important component of plasma membranes. Describe the structure and function of membrane proteins.

[10]

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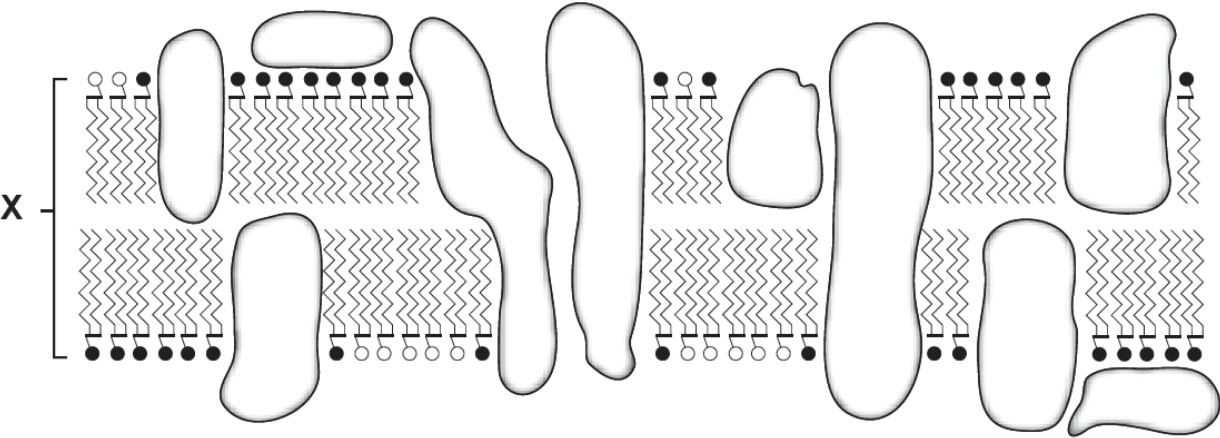
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5. The diagram below shows the fluid mosaic model proposed by Singer and Nicolson in 1972



(a) The width of the membrane as shown by X has been measured using transmission electron microscopes. Membrane width does not vary greatly between different organisms. State a value for this width.

[1]

Membrane width =

(b) Glucose is water soluble. Vitamin A is lipid soluble. Describe and explain how each molecule crosses the membrane shown above.

[4]

Vitamin A

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Glucose

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(c) Beetroot vacuoles contain a red pigment called betacyanin. When beetroot discs are cut with a borer and immersed in a solution of 70% ethanol (an organic solvent) at 15°C, the red pigment begins to leak out of the cells into the ethanol turning it red.

(i) Using your knowledge of the structure of cell membranes, explain why this leakage of pigment occurs.

[2]

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(ii) When the experiment was repeated at 30°C, the time taken for the ethanol to turn red decreased. Explain why.

[2]

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Marking Scheme

1.

Question			Marking details	Marks Available
5.	(a)	(i)	<u>two layers/ double layer of phospholipids</u> ; NOT bilayer	1
		(ii)	<u>fatty acid</u> ;	1
		(iii)	Any 2 from: transport/ form hydrophilic pores/ active transport/ channel proteins/ facilitated diffusion; receptors/ cell recognition; enzyme systems;	2 max
	(b)	Decreased fluidity/ rigid membrane - cells/ membranes more easily damaged (as blood flows)/ cannot pass through capillaries so easily; Membrane proteins change shape / denatured {carriers/ receptors/membrane enzymes} - so {reduced/no} {transport/movement} of molecules;	2	
(c)	Any 2 from: {Unrestricted/ uncontrolled} {Cell division/mitosis}; Forming a mass of cells/ tumour; Preventing {normal cells/ organs} from functioning;	2 max		
Question 5 Total				[8]

2.	Question	Marking details	Marks Available									
1	(a)	(i) Cuboidal; Kidney tubule; Accept kidney/ liver/named gland/ureter/ovary/glands	2									
		(ii) Ciliated; NOT cilia Trachea / oviduct/fallopian tube/ bronchi/bronchioles;	2									
	(b)	<table border="1"> <tr> <td>B</td> <td>nucleus</td> <td>contains <u>DNA</u> which {codes for/ controls} <u>protein synthesis</u>/ transcription/ <u>DNA</u> {synthesis/replication};</td> </tr> <tr> <td>C</td> <td>nuclear pores</td> <td>{Transport/movement} of {mRNA/ nucleotides/rRNA}; Accept ribosomes NOT transport of mRNA in</td> </tr> <tr> <td>D</td> <td>Nucleolus;</td> <td>Produces {rRNA/ribosomes/tRNA}; NOT produces RNA unqualified</td> </tr> </table>	B	nucleus	contains <u>DNA</u> which {codes for/ controls} <u>protein synthesis</u> / transcription/ <u>DNA</u> {synthesis/replication};	C	nuclear pores	{Transport/movement} of {mRNA/ nucleotides/rRNA}; Accept ribosomes NOT transport of mRNA in	D	Nucleolus;	Produces {rRNA/ribosomes/tRNA}; NOT produces RNA unqualified	4
B	nucleus	contains <u>DNA</u> which {codes for/ controls} <u>protein synthesis</u> / transcription/ <u>DNA</u> {synthesis/replication};										
C	nuclear pores	{Transport/movement} of {mRNA/ nucleotides/rRNA}; Accept ribosomes NOT transport of mRNA in										
D	Nucleolus;	Produces {rRNA/ribosomes/tRNA}; NOT produces RNA unqualified										
	(c)	<table border="1"> <tr> <td>Organelle A</td> <td>Nucleus</td> </tr> <tr> <td><u>Inner</u> membrane is folded /</td> <td>No folding of <u>inner</u> membrane /</td> </tr> <tr> <td>Has cristae</td> <td>no cristae;</td> </tr> <tr> <td>No ribosomes attached</td> <td>ribosomes attached;</td> </tr> </table> <p><i>must be comparative</i></p>	Organelle A	Nucleus	<u>Inner</u> membrane is folded /	No folding of <u>inner</u> membrane /	Has cristae	no cristae;	No ribosomes attached	ribosomes attached;	1	
Organelle A	Nucleus											
<u>Inner</u> membrane is folded /	No folding of <u>inner</u> membrane /											
Has cristae	no cristae;											
No ribosomes attached	ribosomes attached;											
	(d)	Ribosomes are not attached to {membranes/ ER} in prokaryotes (some) are in animal cells; Ribosomes are {larger/80S} in animal cells than prokaryotes / 70S; <i>must be comparative</i>	2									
Question 1 Total			[11]									

3. (a)

(i)

OH and H removal shown on diagram;
formation of water (H₂O) shown;
dipeptide correctly drawn with C joined to N; [3]

(ii)

Condensation; [1]

(iii)

Peptide; NOT dipeptide; [1]

(b)

(i)

Mosaic: Proteins are scattered (in lipid layer);
Fluid: molecules / components / (phospho)lipids / proteins are free to move around; [2]

(ii)

B; [1]

(iii)

Drawing shows a lipid bilayer with A and B in the correct places, B intrinsic (through the middle) A extrinsic (on top or bottom, outside phosphate heads);

Need not use N and P, but must be clear which is A and B

any 1 correct label from phospholipid / hydrophobic / hydrophilic / cholesterol / phosphate (head) / lipid or fatty acid (tails);

1

1

(iv)

Cell {recognition / interaction / identification / cell to cell recognition / adhesion / signalling} / receptor qualified e.g. {hormone receptor / antigens}; [1]

(c)

(i)

Secondary; [1]

(ii)

Ribosomes / rough endoplasmic reticulum;

Accept nucleus;

NOT golgi body / nucleolus. [1]

(d)

(i)

Endocytosis (accept phagocytosis / pinocytosis);

NOT exocytosis. [1]

(ii)

Any 2:

Diffusion / osmosis;

Facilitated diffusion;

Active transport; [2]

4.	Question	Marking details	Marks Available	Question	Marking details	Marks Available	
8	(a)	<p>A polysaccharides {are polymers/ formed during condensation reactions};</p> <p>B (monomers are) joined by glycosidic bonds;</p> <p>C starch is made up from <u>alpha</u> glucose;</p> <p>D starch is composed of amylose and amylopectin / contains both 1,4 & 1,6 bonds;</p> <p>E glycogen is made from (alpha) glucose;</p> <p>F {Starch/glycogen} are insoluble and therefore osmotically inert/ OWTTE;</p> <p>G {Starch/glycogen} are storage molecules because {glucose can be added or removed easily / they have a compact structure};</p> <p>H cellulose is composed of <u>beta</u> glucose;</p> <p>I alternate glucose molecules are rotated by 180°/ head up head down structure;</p> <p>J this form long <u>straight</u> chains (of beta glucose)/ only contains 1-4 bonds;</p> <p>K {hydrogen bonds / cross links} form between the chains;</p> <p>L forming microfibrils;</p> <p>M cellulose provides {strength/rigidity} to <u>plant</u> cell walls / cellulose prevents osmotic lysis in plant cells;</p> <p>N in chitin some OH groups are replaced with amino acids / amine groups / glucose amine;</p> <p>O chitin provides strength to <u>fungal</u> cell walls / (arthropod) exoskeletons;</p>	10 max	8	(b)	<p>A globular proteins show tertiary / quaternary structure;</p> <p>B they have a <u>{specific/precise} 3D</u> shape;</p> <p>C their shape is maintained by bonds between (atoms within the) R-groups;</p> <p>D disulphide bridges / ionic bonds / hydrogen bonds / Van der Waals forces / hydrophobic interactions; (any 2) NOT peptide</p> <p>E intrinsic proteins span the membrane;</p> <p>F extrinsic proteins are {embedded in one half of the membrane / on the surface of the membrane};</p> <p>G correct reference {made to the distribution of charge / polar and non-polar groups} on the {intrinsic/extrinsic} proteins;</p> <p>H channel proteins have a hydrophilic pore;</p> <p>I this allows {polar molecules/ions} to pass through the membrane;</p> <p>J by {facilitated} diffusion; NOT active transport</p> <p>K carrier proteins allow the passage of molecules {with a complementary shape/ by the protein changing shape};</p> <p>L by {facilitated diffusion and} <u>active transport</u>;</p> <p>M Glycoproteins contain a carbohydrate chain attached to a protein;</p> <p>N {Glycoproteins/ extrinsic proteins} act as hormone receptors / are involved in cell recognition;</p> <p>O enzymes may be located in the membrane / catalyse reactions / carry out digestion / synthesise ATP;</p>	
					Question 7 Total	[10]	

5.	Question	Marking details	Marks Available
6	(a)	7/8 nm (must have correct units); Accept range of 6-10	1
	(b)	Vitamin A - {Dissolves in /can pass directly through} { <u>phospholipid</u> layer/ <u>hydrophobic</u> regions}; By diffusion; Glucose – Cannot pass through <u>phospholipid</u> layer therefore uses {protein channels/ carriers/ transport proteins/ hydrophilic channels/intrinsic proteins}; By facilitated diffusion; Accept active transport	4
	(c) (i)	Ethanol {dissolves/emulsifies} (phospho) <u>lipids</u> / denatures protein; NOT cell membranes Creates {gaps/holes/pores} in the membrane/ makes membrane more porous; NOT makes membrane more permeable	2
	(ii)	Increased temperature increases <u>kinetic</u> energy of {dye/membrane} molecules; Increases (rate of) <u>diffusion</u> (of dye across membrane)/dye <u>diffuses</u> across the membrane more rapidly;	2
		Question 6 Total	[9]

Examiner's Comments

1. Section (a) was well done in the majority of cases with definitions of double/two layers of phospholipids being the usual response for (i). Many referred to 'tails' in (ii) with no reference to fatty acids; this did not gain credit. In (b) the question involved application of knowledge. Many gained one mark with sensible comments on the consequence of the membrane proteins changing shape, however only the better scripts picked up the second mark with a logical consequence of a more rigid membrane being that they are more easily damaged. (Many candidates must have been revising for BY/HB2 for these summer exams, but very few mentioned blood flow -the ability to transfer knowledge is a skill in itself, even if they did not need it to gain credit for their answer). (c) was somewhat patchy, with many answers being excellent descriptions of what goes wrong to cause cancer. However the general lack of biological knowledge in this question was evident, with many not having any idea about cancer, what it is, or what causes it. (Specification; 1.7 (b) Significance (of mitosis) in terms of damage and disease: repeated cell renewal, damage repair and healing and unrestricted division leading to cancerous growth.)

This comment originally referred to question 5 on paper 1071/01 (21/05/2013)

2. Part (a) was well answered by some candidates. It was clear from these responses that this area of the specification has been covered well and candidates were familiar the different types of epithelia. However, some incorrectly identified the cilia as microvilli or suggested a location as being the small intestine.

Part (b) elicited good responses with many gaining full marks. However vague references to the nucleus controlling cell activities or to mRNA moving into the nucleus were still being made.

This comment originally referred to question 1 on paper 1071/01 (21/05/2014)

3. Most candidates were able to complete the diagram in part (a) (i) however some did not gain all three marks, often omitting to show the formation of a water molecule or by not indicating which atoms would be removed. The great majority of candidates correctly named the condensation reaction in part (a) (ii) and the peptide bond, in part (a) (iii) though we did, fairly regularly, see 'hydrolysis' and 'glycosidic' respectively. Some candidates struggled with their quality of written communication in part (b) (i) failing to show that they understood which components were moving or forming the mosaic affect. The great majority of candidates correctly identified B as forming an extrinsic protein in part (b) (ii), though there were some poor quality drawings in part (b) (iii). Also, there seems to be confusion about what constitutes an extrinsic protein, and the importance of the positioning of the polar and non-polar groups in determining the positioning of the protein in the membrane was often either poorly shown or omitted from the diagrams altogether. The majority of candidates knew one function of the carbohydrate chains in part (b) (iv) but too often candidates described it acting as 'a store of energy'. Parts (c) and (d) were well answered with the majority giving correct responses.

This comment originally referred to question 5 on paper 1071/01 (14/05/2012)

4. There was a fairly even split between the extended questions. Those candidates who chose to answer part (a) on polysaccharides tended to give good accounts, showing they were well prepared and scored highly. A range of marks were achieved on part (b) with some candidates giving very good answers; however many simply tried to write everything they knew about 'protein structure' or 'membrane structure' and therefore only picked up a few marks.

This comment originally referred to question 8 on paper 1071/01 (08/01/2014)

5. Very few candidates were able to state the correct range of membrane width asked for in part (a). The Teachers' guide publishes this as 7/8nm but we accepted any in the range of 6-10nm to allow for other publications. However, many candidates were quoting figures in cm which meant they lacked any concept of the thinness of the cell membrane.

Most candidates answered part (b) well.

Part (c)(i) often elicited references to osmosis and water potential gradient or vague references to ethanol dissolving the membrane. Part (c)(ii) often elicited vague references to "molecules" rather than specifying dye or membrane molecules. Few candidates mentioned diffusion.

This comment originally referred to question 6 on paper 1071/01 (21/05/2014)