4 The chromosomes would not line up in the middle of the cell and attach to the spindle fibres ***[1 mark]***. This could mean that there isn't separation of the sister chromatids, and could result in there being an incorrect amount of genetic material in each daughter cell/mitosis would not progress to anaphase ***[1 mark]***. This disruption of the cell cycle would kill the cancerous cells ***[1 mark]***.

4.4 Cell membranes contain channel proteins and carrier proteins ***[1 mark]***. Proteins are denatured by extremes of pH / extremes of pH interfere with the bonding in proteins, causing them to change shape ***[1 mark]***. If the proteins are not able to function and control what goes in or out of the cell, membrane permeability will increase ***[1 mark]***.

ges 26-28: Cell Membranes — 1

1 Proteins are scattered amongst the phospholipids, like tiles in a mosaic ***[1 mark]***. The phospholipids are constantly moving, so the structure is fluid ***[1 mark]***.

The cholesterol molecules would restrict the movement of the phospholipids ***[1 mark]***, making the structure less fluid and more rigid ***[1 mark]***.

E.g. the cell-surface membranes are likely to have a high proportion of carrier or channel proteins ***[1 mark]*** in order to carry nutrients via facilitated diffusion or active transport ***[1 mark]***. The cell-surface membrane is likely to have a large surface area/microvilli ***[1 mark]*** to maximise the rate of absorption of nutrients ***[1 mark]***.

E.g. a large number of carrier or channel proteins ***[1 mark]*** in order to allow cations to cross the cell membrane quickly ***[1 mark]***.

B ***[1 mark]***

Phospholipids have a hydrophobic tail and a hydrophilic head ***[1 mark]***. The hydrophilic heads are attracted to the water molecules in the cytoplasm or cell surroundings ***[1 mark]***, and the hydrophobic tails are repelled from them, so a bilayer is formed ***[1 mark]***.

The water will move from the exterior to the interior of the cell ***[1 mark]*** because the water potential of the exterior is higher/less negative than the water potential of the interior ***[1 mark]***.

Any five from: e.g. sodium ions are actively transported out of the ileum epithelial cells into the blood ***[1 mark]*** by the sodium-potassium pump ***[1 mark]***. This creates a concentration gradient of sodium ions between the lumen of the ileum and the interior of the epithelial cells ***[1 mark]***. Sodium ions diffuse down this concentration gradient into the epithelial cells ***[1 mark]*** via sodium-glucose co-transporter proteins ***[1 mark]***. The co-transporter proteins transport glucose into the cells along with the sodium ions ***[1 mark]***.

To make sure any betalains/pigments released by the cutting of the beetroot were washed away ***[1 mark]***.

Colorimetry analysis of distilled water ***[1 mark]***.

Any four from: e.g. increasing the temperature from 20 °C to 40 °C increases the fluidity of the phospholipids in the beetroot cell membranes ***[1 mark]***. At temperatures above 40 °C, the membrane starts to break down / proteins in the membrane start to denature ***[1 mark]***. The membrane surrounding the vacuole therefore becomes more permeable with increasing temperature ***[1 mark]***, meaning that betalains/pigments leak out into the distilled water ***[1 mark]***. The more pigments released, the higher the absorbance reading ***[1 mark]***.

Pages 29-30: Cell Membranes — 2

1.1

Concentration of sucrose solution to be made up / mol dm^{-3}	Volume of 1 mol dm^{-3} sucrose solution used / cm^3	Volume of water used / cm^3	Final volume of solution to be made up / cm^3
1	20	0	20
0.75	15	**5**	20
0.5	**10**	**10**	20
0.25	5	**15**	20
0	**0**	**20**	20

[2 marks for all 5 rows correct, otherwise 1 mark for 4 rows correct]

1.2 Any two from: e.g. the temperature the potato samples were incubated at / the length of time the potato samples were incubated for / the volume of sucrose solution used / the variety of potato used / the age of potato used. ***[2 marks]***

1.3 The line of best fit crosses the x-axis of Figure 1 halfway between 0.25 and 0.50, so the sucrose concentration of potato cells = approximately 0.375 mol dm^{-3}.
A 0.3 mol dm^{-3} sucrose solution has a water potential of −850 kPa. A 0.4 mol dm^{-3} sucrose solution has a water potential of −1130 kPa.
So a 0.375 mol dm^{-3} sucrose solution has a water potential of approximately:
$(-1130) - (-850) = 280 \times 0.75 = 210$
$-850 - 210 = \mathbf{-1060}$ **kPa**
[2 marks for an answer > −850 and < −1130 kPa, otherwise 1 mark for estimating the sucrose concentration of the potato cells to be between 0.3 and 0.4 mol dm^{-3}]

1.4 The sweet potato tissue is likely to have a lower water potential than that of the white potato ***[1 mark]*** because it is likely to have a higher sucrose concentration ***[1 mark]***.

The extra sucrose (with some other sugars too) is what makes the sweet potato sweet.

2.1 ATP is made inside the cell, rather than outside it, so the ATP binding site has to face inwards ***[1 mark]***.

2.2 To catalyse the hydrolysis of ATP (into ADP and P_i) ***[1 mark]*** in order to release energy for the active transport of the calcium ions ***[1 mark]***.

2.3 Ca^{2+} ions carry a charge, making them water soluble/hydrophilic ***[1 mark]***. This makes it difficult for them to travel directly through the hydrophobic centre of the phospholipid bilayer ***[1 mark]***.