**1** A white blood cell is an example of a typical eukaryotic animal cell.

(a) Place a cross ☒ in the box next to the correct word or words to complete each of the following statements.

(i) In eukaryotic cells, two organelles with a double membrane are

**(1)**

☒ **A** the nucleus and smooth endoplasmic reticulum

☒ **B** a nucleus and a mitochondrion

☒ **C** a mitochondrion and a ribosome

☒ **D** a mitochondrion and smooth endoplasmic reticulum

(ii) White blood cells, plant cells and prokaryotic cells all contain

**(1)**

☒ **A** a nucleus

☒ **B** Golgi apparatus

☒ **C** ribosomes

☒ **D** smooth endoplasmic reticulum

(iii) A structure present in prokaryotic cells but not present in a white blood cell is

**(1)**

☒ **A** a cell wall

☒ **B** a centriole

☒ **C** a ribosome

☒ **D** rough endoplasmic reticulum

(b) There are several types of stem cell found in humans.

The table below shows some features of two types of stem cell. If the feature applies to the stem cell place a tick (✓) in the box and if it does not apply, place a cross (✗) in the box.

**(2)**

| Features | Totipotent stem cell | Pluripotent stem cell |
|---|---|---|
| Can give rise to totipotent stem cells | | |
| Can give rise to differentiated cells | | |

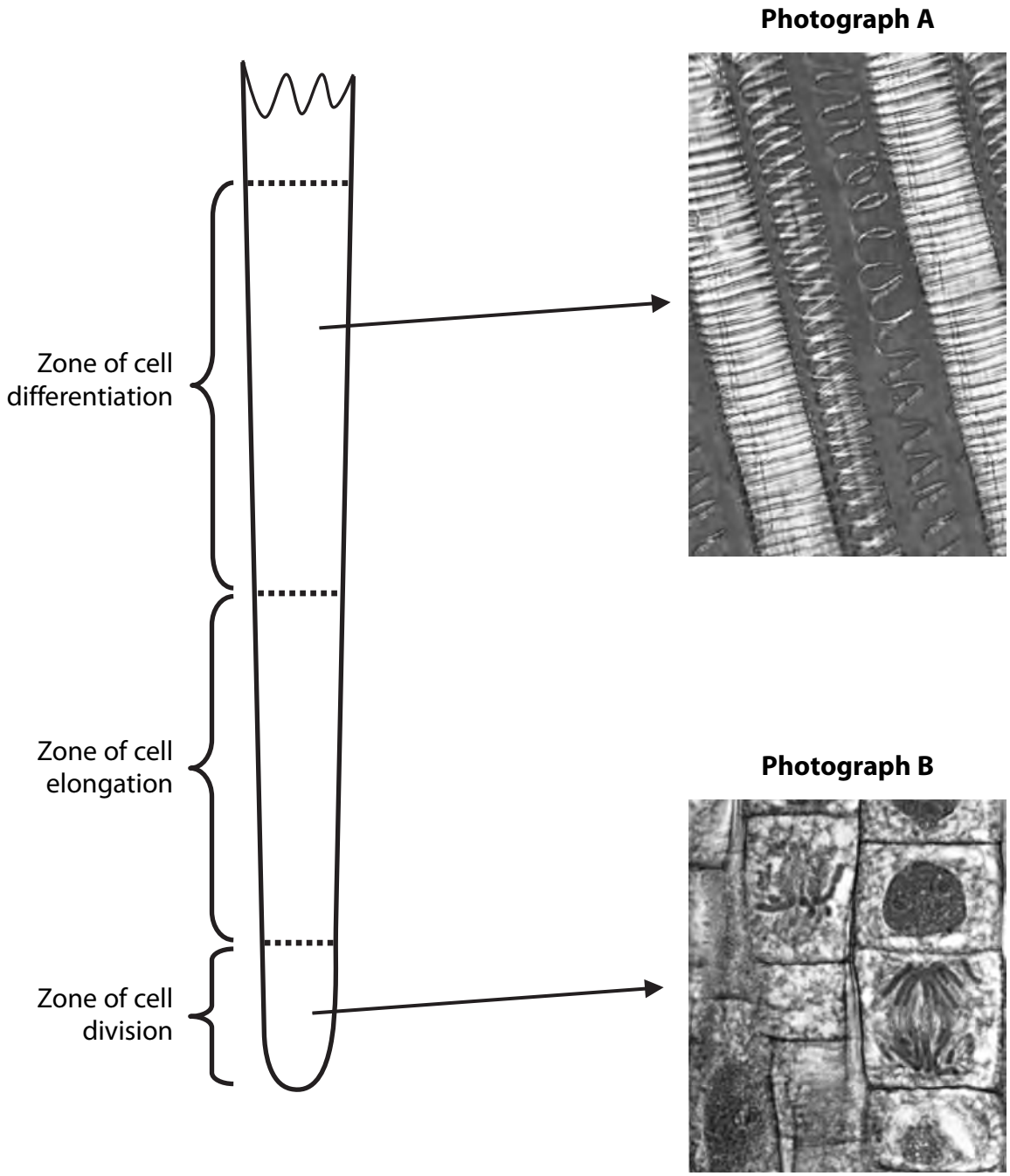
*(c) Human bone marrow contains stem cells that can give rise to various types of blood cell including white blood cells.
Suggest how a stem cell in the bone marrow can become a differentiated blood cell.

**(4)**

**(Total for Question 1 = 9 marks)**

**2** In the roots of plants, cell division, cell elongation (growth) and cell differentiation occur in different zones near the root tip.

The diagram below show the three different zones in a root. Photographs **A** and **B** show some of the tissues present in two of these zones.



(a) (i) Name the specialised tissue shown in photograph **A**.

**(1)**

*(ii) Describe and explain how this tissue is adapted for the transport of water and support in a plant.

**(4)**

(b) Explain how differential gene expression could result in the specialisation of cells.

**(3)**

(c) Only one of the two tissues shown in the photographs **A** and **B** is totipotent. Describe how you could use a plant tissue culture technique to show which of the two tissues is totipotent.

**(4)**

**(Total for Question 2 = 12 marks)**

**3** During an infection, some white blood cells make glycoproteins which become part of their cell surface membranes. To make glycoproteins, the white blood cells must first synthesise proteins on the surface of their rough endoplasmic reticulum.

(a) Explain how these newly-made proteins end up as glycoproteins on the cell surface membrane.

**(5)**

(b) There are certain rare blood disorders in which there is a shortage of white blood cells. One potential treatment would be to inject totipotent stem cells into individuals with these disorders.

(i) Explain what is meant by the term **totipotent stem cell**.

**(2)**

(ii) Suggest why injecting totipotent stem cells may benefit a person with a shortage of white blood cells.

**(1)**

(iii) Suggest **one** risk to the person receiving the stem cells.

**(1)**

**(Total for Question 3 = 9 marks)**