A Level Biology A

H420/01 Biological Processes

Question Set 7

7 (a) Fig. 22.1 is a cross section of part of the cortex of a mammalian kidney.

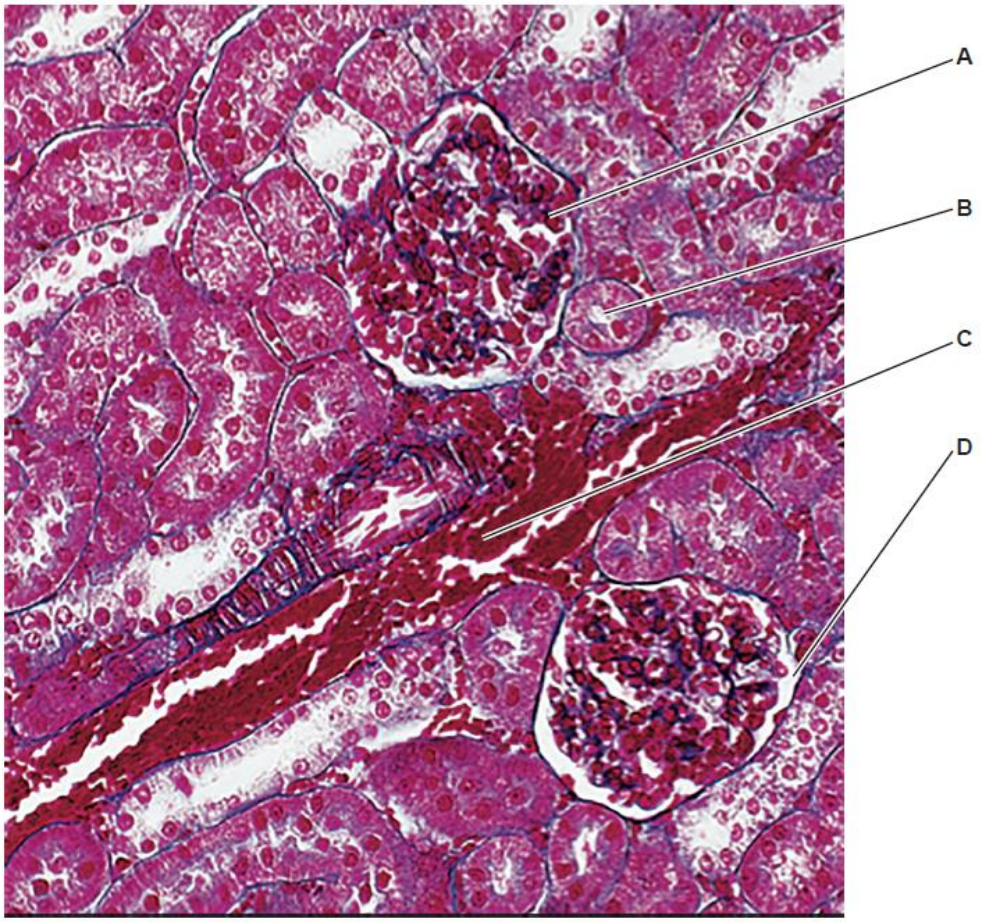

Fig. 22.1

(i) Which **two** letters identify regions that **do not** contain plasma proteins? **[1]**

B, D

(ii) Which letter identifies the region with the highest hydrostatic pressure? **[1]**

A

7 (b) (i) Studies of the cell surface membranes of the **distal** convoluted tubule have provided thefollowing evidence:

- Sodium-potassium pumps:
  - move potassium ions from the blood to the tubule fluid
  - move sodium ions from the tubule fluid to the blood
  - use ATP in these processes.
- Sodium-calcium co-transport proteins:
  - move calcium ions from the tubule fluid to the blood
  - move sodium ions into the tubule fluid
  - use the electrochemical gradient of sodium ions to drive this process.

Using this information and your own knowledge, compare the processes occurring in the **proximal** and **distal** convoluted tubules. **[3]**

Processes in both the PCT and DCT involve active transport, co-transport and selective reabsorption. However, whilst in the DCT co-transport involves ions only, in the PCT, co-transport of glucose, amino acids and ions occurs.

7 (b) (ii) Nephrogenic diabetes insipidus is a disease of the kidney that affects the regulation of water potential in the blood. One cause is lithium poisoning. Lithium ions enter the kidneytubules through sodium channels.

This prevents the cells of the collecting duct from responding to ADH in the blood.

State and explain **one** symptom you would expect to observe as a result of nephrogenicdiabetes insipidus. **[2]**

Increased thirst response. The cells of the collecting duct cannot respond to ADH so fewer aquaporins are inserted into the plasma membrane of cells in the collecting duct wall. Less water is reabsorbed from the collecting duct so more water is lost in urine.

7 (c) (i) Fig. 22.2 shows a podocyte from the kidney. The many gaps between the microscopicprocesses form fenestrations in the Bowman's capsule.

Fig. 22.2

Suggest and explain why podocytes are usually unable to undergo mitosis. **[3]**

They have already differentiated and become specialised so cannot undergo mitosis. If mitosis did occur, it would alter the architecture of their cytoskeleton and subsequently change their shape. The number, size and shape of the filtration slits would change, altering the size of molecules that could pass into the Bowman's capsule during ultrafiltration

7 (c) (ii) Studies show that after damage by infection or injury, it is possible for nephron tissues tobe regenerated. Adult stem cells are involved in this process.

State **two** properties of adult stem cells make them suitable for regeneration of tissues in the kidney? **[2]**

Adult stem cells are multipotent. They can divide indefinitely and differentiate into all cell types of the kidney, regenerating whole tissues from a few cells.

Total Marks for Question Set 7: 12