Name of the Student:_____
Max. Marks : 23 Marks **Time : 23 Minutes**

Q1.

(a) Dopamine is a neurotransmitter released in some synapses in the brain. The transmission of dopamine is similar to that of acetylcholine.

Dopamine stimulates the production of nerve impulses in postsynaptic neurones.

Describe how.

Do **not** include in your answer the events leading to the release of dopamine and the events following production of nerve impulses at postsynaptic neurones.

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(3)

(b) Dopamine has a role in numerous processes in the brain including pain relief. The release of dopamine can be stimulated by chemicals called endorphins produced in the brain. Endorphins attach to opioid receptors on presynaptic neurones that release dopamine.

Morphine is a drug that has a similar structure to endorphins and can provide pain relief.

Explain how.

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(2)

(c) GABA is a neurotransmitter released in some inhibitory synapses in the brain. GABA causes negatively charged chloride ions to enter postsynaptic neurones.

Explain how this inhibits postsynaptic neurones.

(3)

(Total 8 marks)

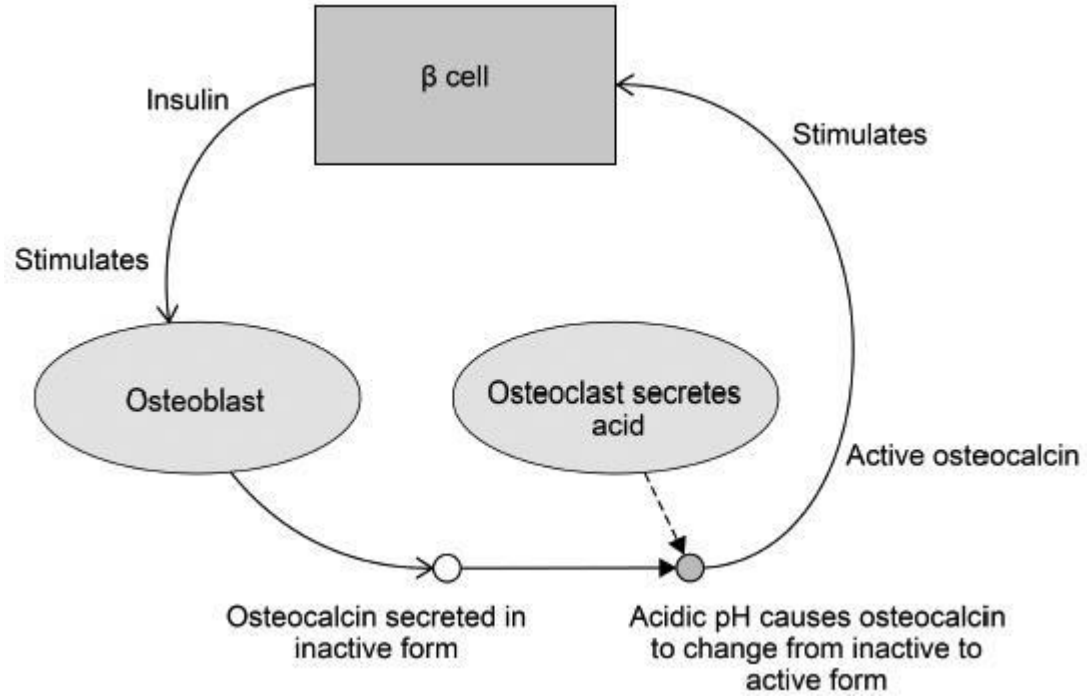
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Q2.

Broken bones are repaired by cells called osteoclasts and osteoblasts.

Osteoblasts secrete a hormone called osteocalcin in an inactive form. Osteocalcin is a protein. The active form of osteocalcin binds to a receptor on beta (β) cells in the pancreas, stimulating them to release insulin. Osteoblasts have receptors for insulin.

The diagram shows how the production of osteocalcin by osteoblasts is controlled by positive feedback.



(a) The secretion of osteocalcin (in an inactive form) by osteoblasts is controlled by positive feedback.

Use information from the diagram to explain why this is positive feedback.

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(2)

(b) The acidic pH conditions created by osteoclasts cause the inactive form of the protein osteocalcin to change into the active form of osteocalcin.

Suggest how.

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(2)

(c) Binding of insulin leads to an increase in the rate of respiration in cells such as osteoblasts.

Explain how.

(2)

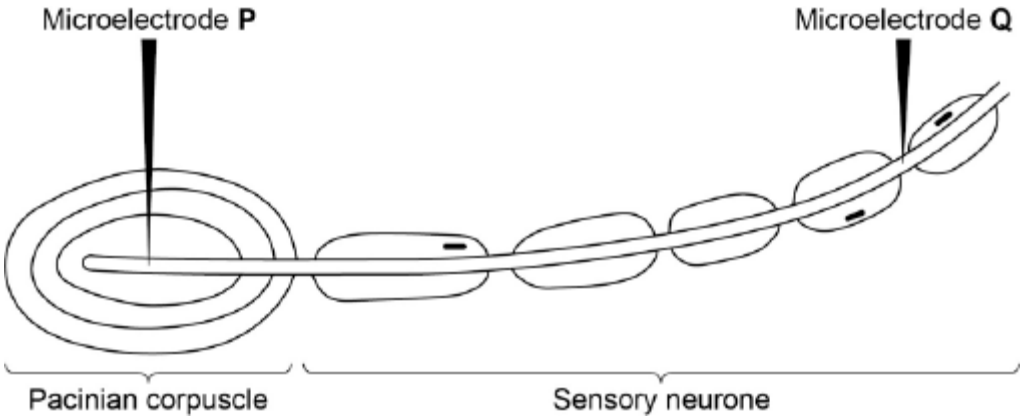
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Q3.

A biologist investigated the stimulation of a Pacinian corpuscle in the skin of a fingertip.
She used microelectrodes to measure the maximum membrane potential of a Pacinian corpuscle and its sensory neurone when different pressures were applied to the fingertip.

The figure below shows the Pacinian corpuscle, its sensory neurone and the position of the microelectrodes.



The table below shows some of the biologist's results.

Pressure applied to the fingertip	Membrane potential at P / millivolts	Membrane potential at Q / millivolts
None	–70	–70
Light	–50	–70
Medium	+30	+40
Heavy	+40	+40

(a) Explain how the resting potential of –70 mV is maintained in the sensory neurone when no pressure is applied.

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(2)

(b) Explain how applying pressure to the Pacinian corpuscle produces the changes in membrane potential recorded by microelectrode **P**.

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(3)

(c) The membrane potential at **Q** was the same whether medium or heavy pressure was applied to the finger tip. Explain why.

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(2)

(d) Multiple sclerosis is a disease in which parts of the myelin sheaths surrounding neurones are destroyed. Explain how this results in slower responses to stimuli.

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(2)

(Total 9 marks)

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