



CHEMISTRY ONLINE
— TUITION —

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BIOLOGY

ORGANISMS RESPOND TO CHANGES IN ENVIRONMENTS

Level & Board	AQA (A-LEVEL)
TOPIC:	HOMEOSTASIS
PAPER TYPE:	QUESTION PAPER - 1
TOTAL QUESTIONS	5
TOTAL MARKS	20

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Homeostasis - 1

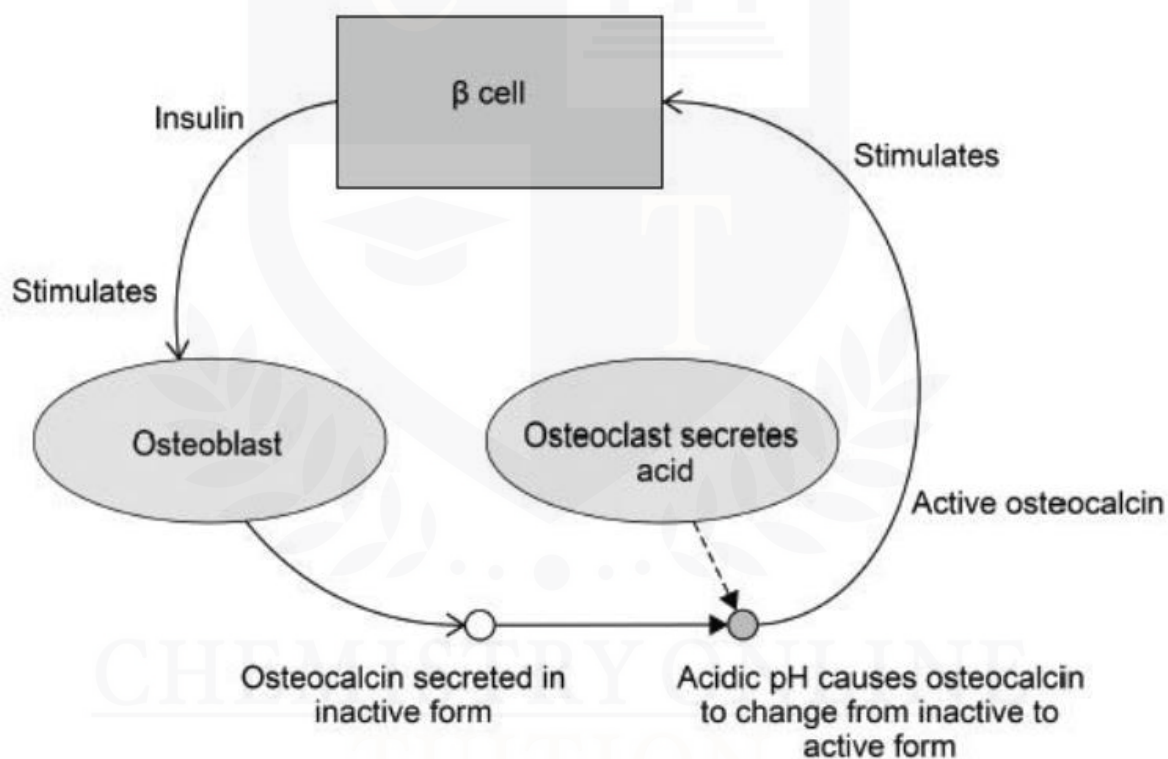
1.

Osteoclasts and osteoblasts are the cells that mend broken bones.

An inert hormone known as osteocalcin is secreted by osteoblasts.

A protein is osteocalcin. The pancreatic beta (β) cells are stimulated to release insulin when the active form of osteocalcin attaches to a receptor on these cells. Osteoblasts contain insulin receptors on them.

The figure illustrates how positive feedback regulates osteoblasts' synthesis of osteocalcin.



(a) Positive feedback regulates osteoblasts' release of osteocalcin (in an inactive form).

Make use of the diagram's content to clarify why this is positive feedback. (2)

(b) The protein osteocalcin undergoes a transformation from its inactive form to its active form because to the acidic pH circumstances produced by osteoclasts.

Provide how. **(2)**

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(c) When cells like osteoblasts bind to insulin, their rate of respiration increases.

Describe how. (2)

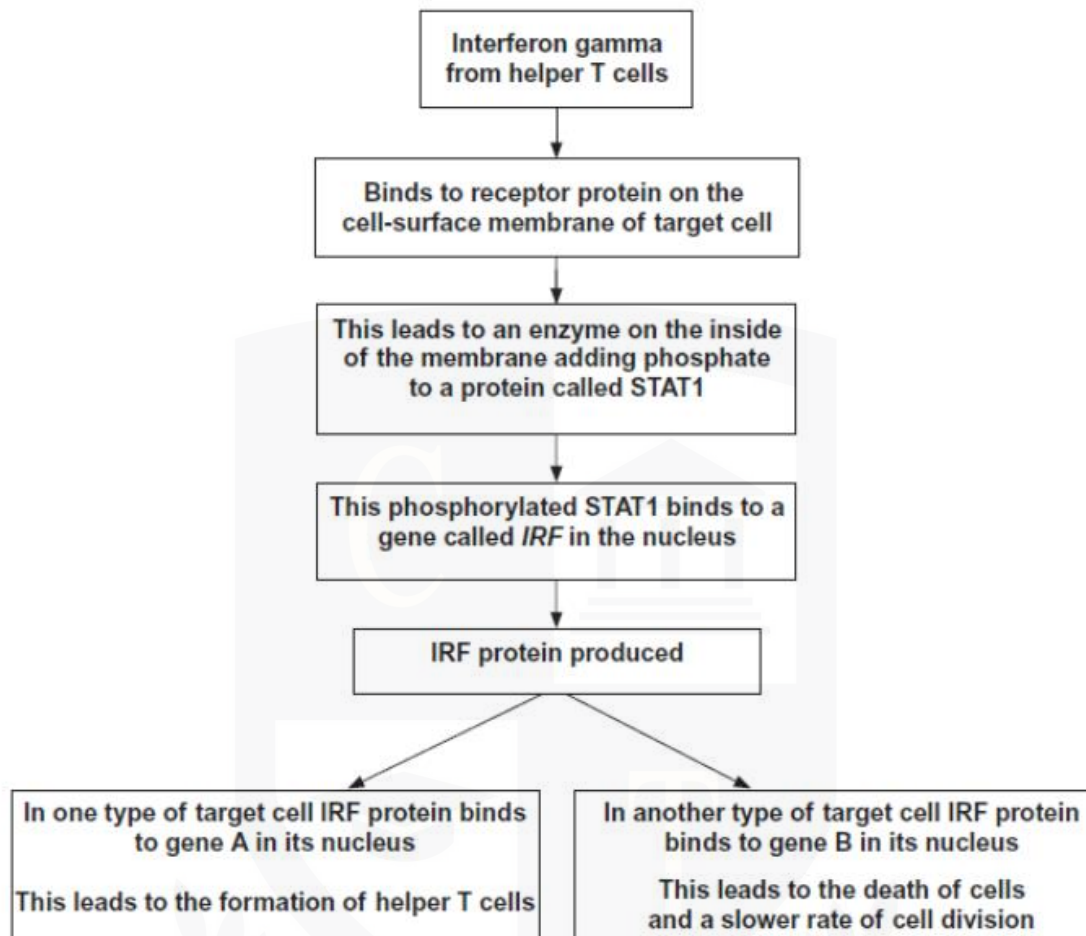


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2.

Interferon gamma is a chemical released by several types of white blood cells, including helper T cells. It regulates the synthesis of a number of proteins by target cells. Which protein is generated depends on the type of target cell. The graphic depicts how interferon gamma regulates three genes.

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(a) Make suggestions about how phosphorylated STAT1 is produced as a result of interferon gamma binding to its receptor protein using the information in the diagram. **(2)**

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(b) In the diagram, identify the two transcription factors. **(2)**



(c) Positive feedback is seen by the way interferon gamma controls the development of helper T cells.

Justify its inclusion as an illustration of good feedback. **(2)**

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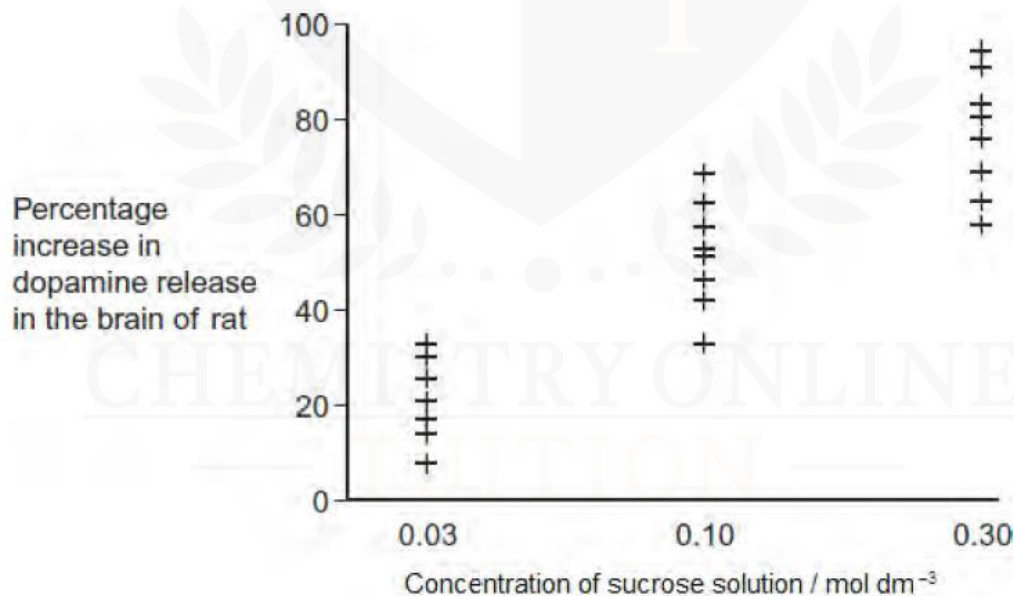
3.

The urge to eat is increased in certain parts of the brain due to the production of a chemical called dopamine.

When rats were given varying quantities of sucrose solution to drink, scientists saw increases in dopamine release in their brains.

The tongue's taste receptors are stimulated by sucrose.

Their results are displayed in the graph. One rat's outcome is represented by each point.



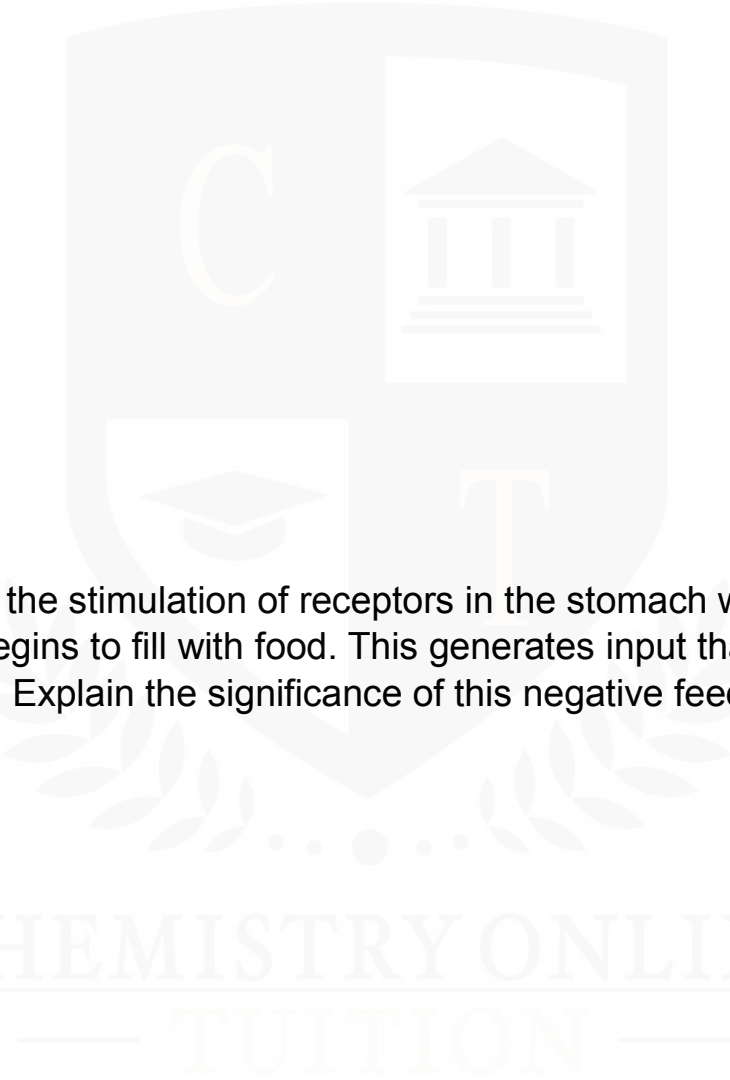
(a) The rodents desire to eat was positively impacted by drinking a sugar solution, the scientists concluded.

How does this conclusion get supported by the data? **(3)**



(b) According to this study, the frequency of nerve impulses from each taste receptor to the brain increased with the amount of sucrose present in the rat's mouth.

The refractory time prevents information about concentration variations from reaching the brain when rats are given very high doses of sucrose solution to drink. Describe your reasoning. **(2)**



(c) In humans, the stimulation of receptors in the stomach wall occurs when the stomach begins to fill with food. This generates input that is unfavorable to the appetite. Explain the significance of this negative feedback. **(3)**

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4.

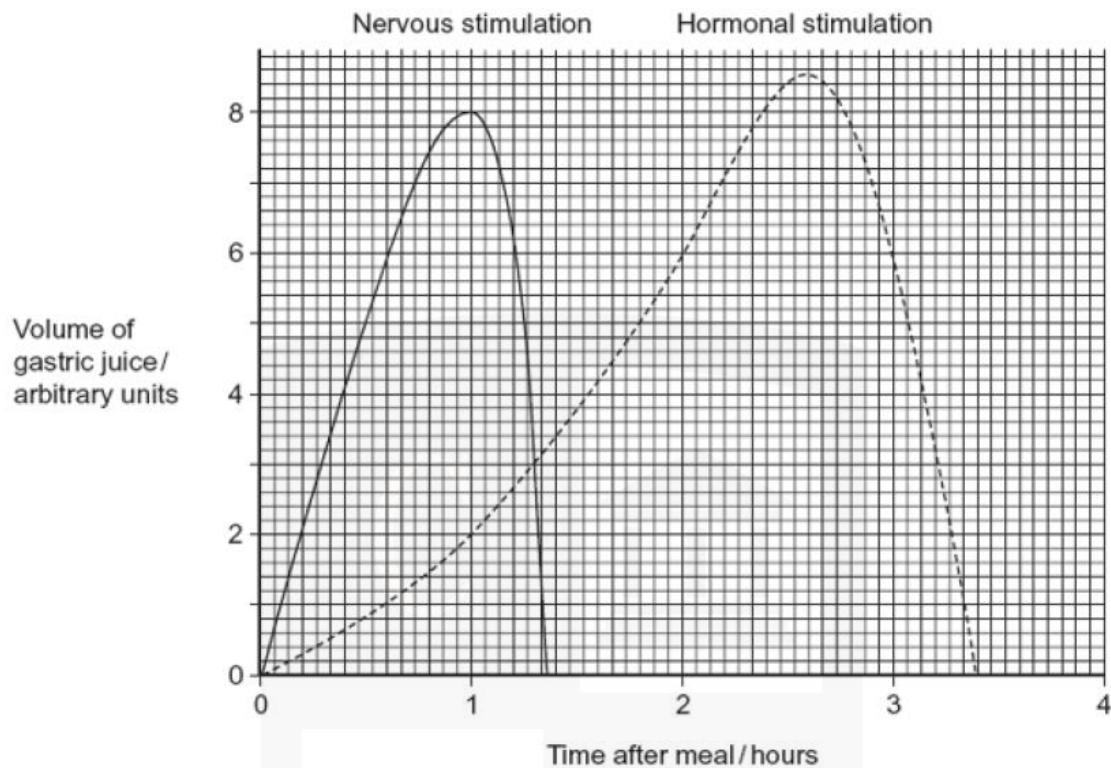
Animal reactions are coordinated by a variety of chemicals.

(a) Synapses only go in one way. Describe how acetylcholine makes a synapse unidirectional. **(2)**



5.

Cells in the stomach wall release gastric juice after a meal. The graph shows how the volumes of gastric juice produced by nervous stimulation and by hormonal stimulation change after a meal.



(a) Explain the graph's evidence that curve A indicates the amount of stomach juice produced in response to nerve stimulation. (2)

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(b) Fill in the table to indicate the proportion of gastric juice generated at the indicated timeframes due to nerve stimulation. **(1)**

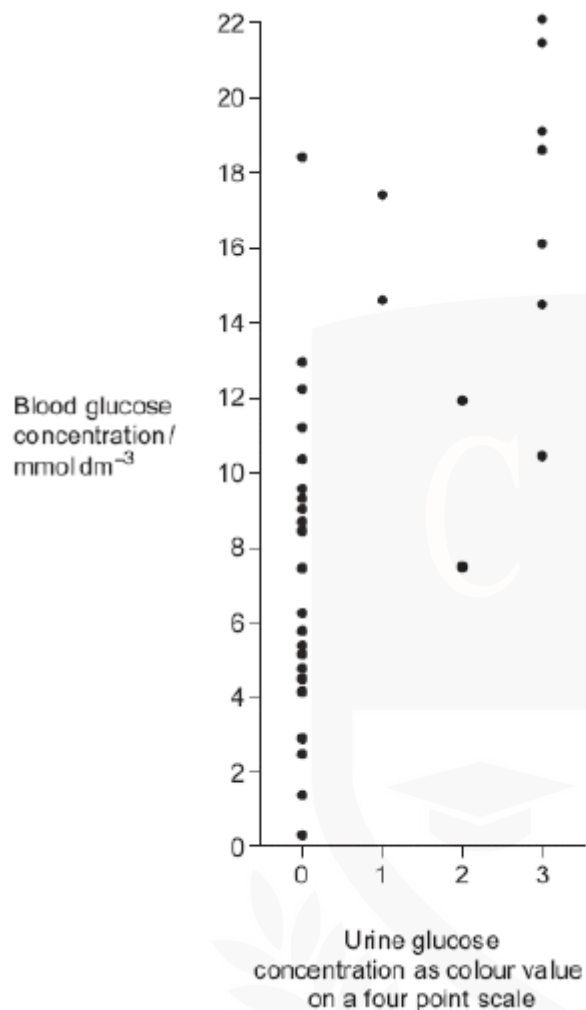
Percentage of gastric juice produced by nervous stimulation	Time after meal / hours		
	1	2	3

6.

Over the course of a year, lab technicians at a hospital examined urine and blood samples from a girl who had diabetes on a regular basis. Every time the technicians took a urine sample, they also took a blood glucose reading. The graph displays their findings.

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(a) The girl who took part in this investigation was being successfully treated with insulin. The graph shows that on some occasions, the concentration of glucose in her blood was very high. Suggest why. **(2)**

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(b) To assess the efficacy of the urine test as a blood glucose concentration indicator, utilize the graph. **(3)**



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