

## A. Homeostasis

1. The body has two automatic control systems; these systems may involve nervous responses or chemical responses.

Compare the structure and mode of action of the two control systems. (4)

*Any 2 comparisons*

- *nervous system transmits electrical impulses whereas the chemical system involves chemicals called hormones.*
- *nervous impulses are transmitted along special cells called neurones whereas hormones are transported in the blood plasma to target cells.*
- *transmission of impulses in the nervous system is quick and lasts only a short time whereas transmission of impulses in the chemical system are slower but the effect lasts longer*

2. Homeostasis maintains optimal conditions for enzyme action.

Explain what this statement means. (4)

- *enzymes work in optimal conditions e.g. pH and temperature*
- *they control chemical reactions in the body*
- *if these conditions are not kept in balance/optimal conditions by homeostasis*
- *enzymes may denature*
- *the rate of chemical reactions may be too low*  
*(Allow any correct examples)*

## B. The human nervous system Part 1

1. Joanna eats a toxic waste sweet, she feels a tingling in her mouth and her salivary glands releases saliva.

This is an example of a reflex action. Toxic waste sweets are covered in citric acid.

a. Describe the pathway of the reflex action and explain why her body reacted that way. (4)

*Description (any 4)*

- *stimulus – sour citric acid*
- *receptors – chemical receptors on the tongue*
- *sensory neurone – impulse to the...*
- *relay neurone in the CNS – impulses to the...*
- *motor neurone – impulses to ....*
- *the effectors (salivary glands).*
- *response – saliva produced*

*Explanation (any 2)*

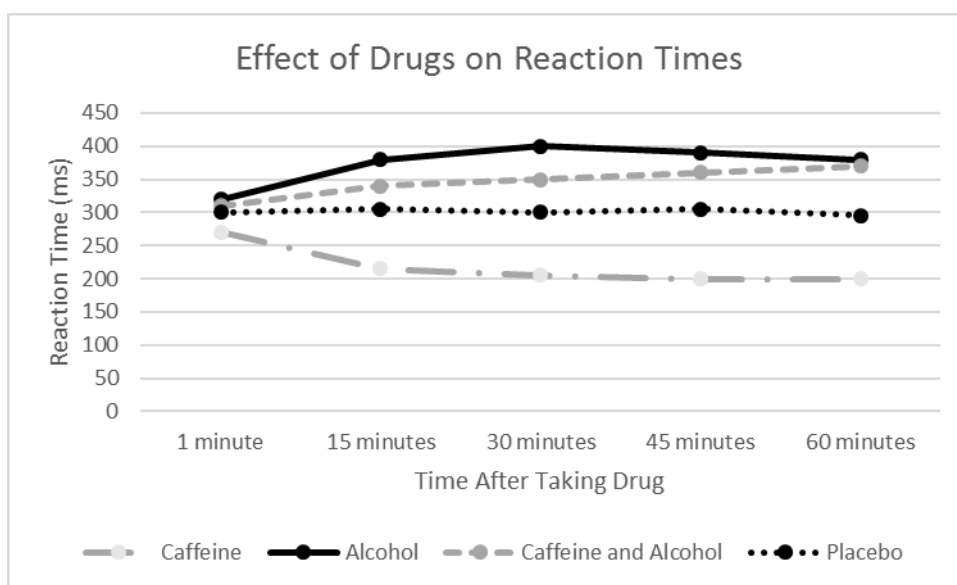
- *the sweet is covered in acid*
- *acids are sour*
- *acids can damage the teeth*
- *saliva is produced to dilute/neutralise the acid*

b. Explain why reflex actions do not involve the conscious part of the brain (2)

- *so, they are rapid/quick*
- *less change of damage to the body*

2. Scientists investigated the effects of caffeine and alcohol on people's reaction times.

Their results are shown in **the graph**.



Use the data in **the graph** to compare the effect of the different drugs on reaction times. (4)

*Any 4 from:*

*must compare at least two with linking points.*

*caffeine only:*

- *decreased reaction time (RT) down to 200ms*
- *RT steady at 200ms from 30 to 60 mins*

*alcohol only:*

- *increased RT up to maximum of 400ms at 30 mins*
- *RT falls to 60 mins but not back to normal*

*alcohol and caffeine:*

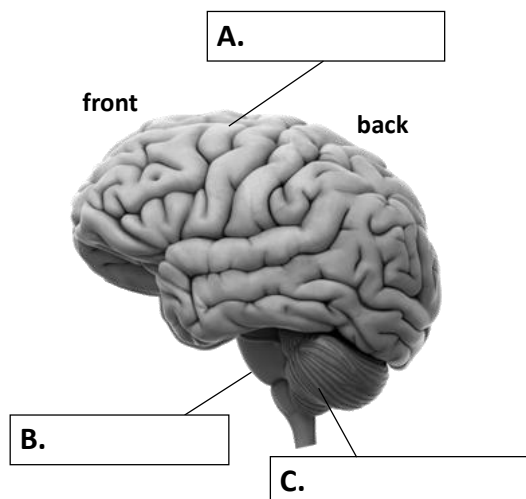
- *RT increases but not as much as the alcohol only*
- *continues to rise at 60 mins*

*placebo:*

- *no effect on RT*

## C. The human nervous system Part 2 (biology only)

1. The diagram below shows the structure of the brain. (3)



a. Name the structures A, B and C.

- *A = cerebral cortex*
- *B = medulla*
- *C = cerebellum*

b. Describe and explain the function of each of the structure in part a. (3)

- A. cerebral cortex – is responsible for intelligence, language, memory and consciousness*
- B. medulla – is responsible for involuntary coordination such as breathing, swallowing and heart rate.*
- C. cerebellum - is responsible for voluntary coordination of the muscles*

2. Extended response question:

Neuroscientists have been able to map the regions of the brain to particular functions by studying patients with brain damage.

Describe and explain the methods they use to do this. (6)

- *Level 3 (5-6 marks)*  
*Describe and explains studying brain damage, EEG and MRI*
- *Level 2 (3-4 marks)*  
*Describes and explains either studying brain damage, EEG or MRI or describes ALL*
- *Level 1 (1-2 marks)*  
*Makes a basic attempt to describe studying brain damage, EEG or MRI*

*Brain damage*

- *they can be studying patients with brain damage*
- *damage to different brain areas produces different behavioural and psychological effects*
- *by electrically stimulating different parts of the brain*

## EEG:

- *an electroencephalogram (EEG) is a test used to find problems related to electrical activity of the brain*
- *an EEG tracks and records brain wave patterns*
- *by stimulating different parts of the brain and observing what happens*

## MRI:

- *it is possible to get a greater understanding of what different areas of the brain do*
- *using magnetic resonance imaging (MRI) scanning*
- *it uses strong magnetic fields and radio waves to produce detailed images of the brain and spinal cord*
- *it consists of a large tube containing powerful magnets.*
- *MRI can distinguish between different types of tissues, including detecting cancerous cells.*

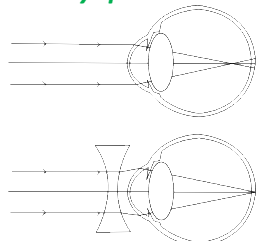
3. Two common defects of the eyes are myopia (short sightedness) and hyperopia (long sightedness) in which rays of light do not focus on the retina.

Explain why people cannot see clearly with each of these defects.

You should use diagrams to explain each defect. (6)

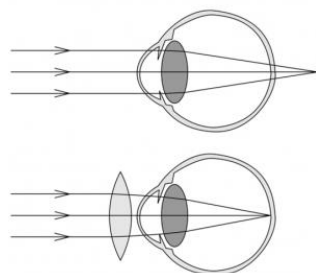
## Myopia (max 3)

- *cannot focus on objects that are far away*
- *it usually occurs when the eyeball is too long*
- *the light rays from distant objects focus in the eyeball in front of the retina*
- *myopia can be corrected with concave lenses so that the light rays focus on the retina*



## Hyperopia (max 3)

- *cannot focus on objects that are near*
- *it usually occurs when the eyeball is too short*
- *the light rays from distant objects focus in the eyeball behind the retina*
- *myopia can be corrected with convex lenses so that the light rays focus on the retina*



## D. Hormonal coordination in humans Part 1

1. Explain why your skin may go pink or red when you are hot. (4)

- *blood vessels near the surface of the skin*
- *dilate/get wider*
- *more blood flows near the surface of the skin*
- *thermal energy/heat is transferred from the skin to the surrounding*

2. Michael is a pensioner; his heating was not working, and his core body temperature was only 34°C. He was suffering from hypothermia.

His granddaughter called an ambulance, she had given him hot water bottles for his hands and feet. When the paramedics got to Michael's house they explained to his granddaughter why this was not a good idea and that warming his hand and feet would reduce his core temperature.

a. What is the optimum core body temperature? (1)

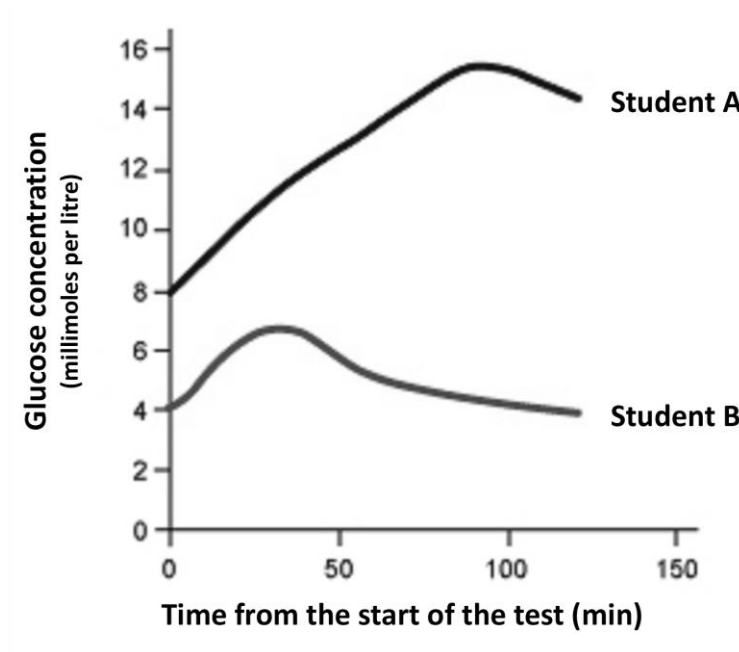
- *37°C*

b. Explain why warming Michaels hands and feet caused his core temperature to fall. (3)

- *hot water bottle would increase the blood flow to the skin*
- *this would cause a drop in michael's core temperature*
- *enzymes would not be able to work as efficiently*
- *due to low temperature therefore less, collisions with the active site*

3. Two university students were studying the effects of drinking glucose solution on their blood glucose levels.

The graph shows their results.



a. i. One of the students had Type 1 diabetes. Which student was this? (1)

ii. Explain your answer (2)

- *students A*
- *because their blood glucose levels remain high*
- *they do not return*

b. Describe what Type 1 diabetes is and how it is normally treated. (3)

- *disorder in where the pancreas fails to produce enough insulin*
- *causes uncontrolled high blood glucose*
- *normally treated with insulin injections*

c. Explain how the blood glucose levels are controlled in a person without diabetes after they have a high glucose drink. (4)

*Any 4*

- *if the blood glucose concentration is too high*
- *the pancreas produces the hormone insulin this ....*
- *causes glucose to move from the blood into ...*
- *the cells, in liver and muscle cells excess glucose is converted....*
- *to glycogen for storage*

## **E. Hormonal coordination in humans Part 2 (biology only)**

1. Extended response question:

Explain the effect on red blood cells as the blood glucose level rises above and below normal levels. (6)

- *Level 3 (5-6 marks)*  
*Describe and explain both crenation and lysis due to osmosis*
- *Level 2 (3-4 marks)*  
*Describe both crenation and lysis mentions osmosis*
- *Level 1 (1-2 marks)*  
*Makes a basic attempt to describe either crenation or lysis*

*Blood glucose levels above normal:*

- *The blood plasma is hypertonic (more concentrated) than the cytoplasm of the red blood cell*
- *Water moves down the concentration gradient*
- *Via osmosis from the cell into the plasma*
- *This causes the pressure and volume to decrease*
- *This is called crenation*

*Blood glucose levels below normal:*

- *The blood plasma is hypotonic (less concentrated) than the cytoplasm of the red blood cell*
- *Water moves down the concentration gradient*
- *Via osmosis from the plasma into the cells*
- *This causes the pressure and volume to increase*
- *The cell then bursts this is called lysis*

2. Many people who are interested in increasing their muscle size take protein supplements. These are often in the form of 'shakes' they are taken in addition to a normal diet. If a person does not exercise enough when taking these then excess amino acids are formed.



a. Explain how excess amino acids are excreted safely from the body. (4)

*Any 4*

- *In the liver*
- *amino acids are deaminated (amino group removed)*
- *ammonia is formed*
- *ammonia is toxic*
- *ammonia converted to urea for safe excretion in the urine (via the kidneys)*

b. Describe how the kidneys produce urine. (3)

- *Blood is filtered to remove glucose, urea, ions (salts) and water from the blood*
- *All glucose, some ions (salts) and some water are selectively reabsorbed*
- *All urea, some ions (salts) and excess water are excreted into the urine*

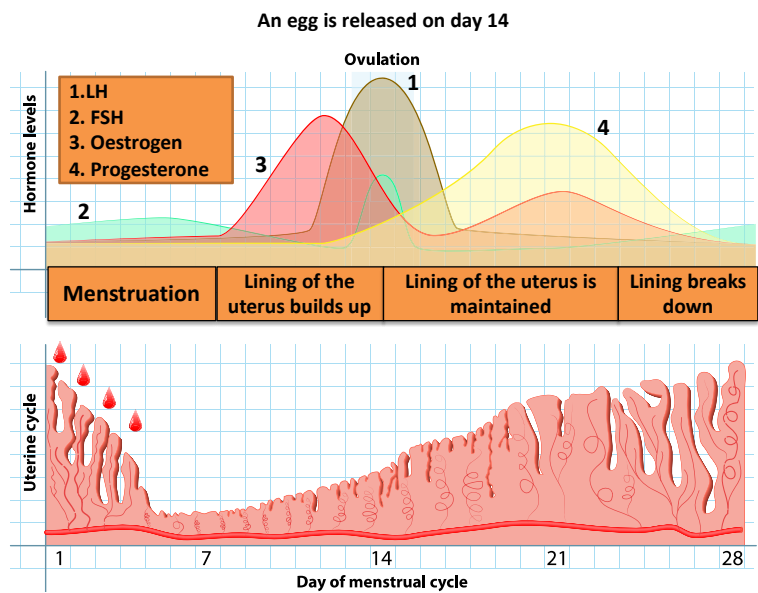
3. HT: Describe how the blood is controlled by ADH. (5)

*Any 5*

- *ADH is released by the pituitary gland*
- *when the blood is too concentrated*
- *it causes more water*
- *to be reabsorbed back into the blood*
- *from the kidney tubules*
- *by negative feedback*

## F. Hormonal coordination in humans Part 3

1.



a. Describe the role of each of the hormones in the menstrual cycle. (4)

- *FSH stimulates oestrogen (production) / egg maturation / egg ripening*
- *oestrogen inhibits FSH / stimulates LH / builds up uterine lining*
- *LH stimulates egg / ovum release / ovulation / inhibits oestrogen*
- *progesterone maintains the lining of the uterus*
- 

b. How do changes in the uterine lining adapt it for a fertilised egg. (2)

- *increased thickness so a fertilised egg can attach*
- *increased blood vessels to provide nutrients for the fertilised egg*

2. Evaluate the condom and the contraceptive implant as methods of contraception. (5)

*Condom: (1 advantage and 1 disadvantage)*

- *Stops the sperm getting to egg to prevent pregnancy*
- *Readily available from doctors/supermarkets/shops/family planning clinics*
- *Helps prevent the spread of sexually transmitted diseases*
- *Interrupts the spontaneity of sexual intercourse*
- *May not be used properly and slip off during intercourse*
- *Some people may be allergic to latex*

*Implant: (1 advantage and 1 disadvantage)*

- *Slow release of progesterone to inhibit the maturation of eggs*
- *Don't have to remember to take a pill everyday*
- *Lasts for many months/years*
- *Does not prevent sexually transmitted diseases*
- *Have to be removed if a woman wishes to get pregnant*

*Students own evaluative comment (1)*



## G. Plant hormones (biology only)

### 1. Extended response question:

Auxin is a plant hormone that controls growth.



Describe and explain how auxin has made the plant grow towards the light. (6)

- Level 3 (5-6 marks)  
*The answer is well organised, clearly outlining the stages of phototropism including uneven distribution of hormone and cell elongation.*
- Level 2 (3-4 marks)  
*The answer demonstrates an understanding of phototropism. Some keywords are used appropriately.*
- Level 1 (1-2 marks)  
*The answer identifies some of the stages of phototropism but is unclear on how auxin influences growth.*
- *auxin is present in the plant.*
- *light stimulates auxin to move to the shaded side of the plant*
- *auxin promotes cell elongation*
- *longer cells (on the shaded side) causes the plant to tilt towards the light source*

2. A team of scientists studied the effect of two weedkillers. Weedgone contained a plant growth hormone, Weedaway did not.

They tested the two weedkillers on potato crops and measured how many kilograms of potatoes were produced.

a. Name one control variable and describe how they should keep it constant (2)

*Variable and method must be linked to gain both marks*

- *size of field - measure*
- *amount of water – measure rainfall/control volume*
- *amount of light – light meter/control lighting/provide artificial*
- *temperature – thermometer/heaters*
- *other chemicals used – use/not, measure use/volume/etc.*

b. Here are the results of their investigation:

Year	2008	2009	2010	2011	2012
Kg of potatoes from field treated with Weedgone (plant hormone)	51	42	50	52	51
Kg of potatoes from field treated with Weedaway	38	37	36	38	37

i. Calculate the mean for Weedgone. (2)

- **51 (2 marks)**
- **evidence of 204/4 (1 mark)**

ii. Use the data to describe the effect of the plant hormone on the mass of potatoes produced. (2)

- **more potatoes produced/greater mass**
- **use of data to support**