

IGCSE and GCSE Biology. Answers to questions

Section 3. Human physiology.

Chapter 18 The senses

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1. Theoretically you would expect to feel only touch. Warmth and pressure are detected by their own receptors. In practice it might be difficult to hit only a touch receptor, depending on which part of the skin is being tested.
2. The temperature receptors which respond to heat loss will send impulses to the brain. So will touch and pressure receptors. If the ice is held there long enough it might stimulate pain receptors.
3. Temperature receptors, touch and pressure receptors, pain receptors.

Chapter 19 Co-ordination

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1. A nerve fibre is part of a single cell and is microscopic (about 1-20 μ diameter). A nerve consists of hundreds of nerve fibres bundled together in a protective sheath and is visible to the naked eye (in dissections).
2. **a** Sensory and motor neurones are both single cells consisting of a cell body with a nucleus and a long nerve fibre usually running between the central nervous system and a peripheral structure.
b Both neurones conduct electrical impulses.
Sensory neurones originate in a sensory structure and conduct impulses towards the central nervous system. Their cell bodies are not terminal though still in the central nervous system. Motor neurones have their cell bodies in the central nervous system. They conduct impulses away from the CNS to an effector organ.
3. **a** A nerve fibre can carry only sensory or motor impulses.
b A nerve (a mixed nerve) can carry both sensory and motor fibres and therefore can transmit both sensory and motor impulses.

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1. Fig. 19.7 **a** Cell bodies 2 **b** Synapses 1
Fig. 19.9 **a** Cell bodies 7 **b** Synapses 5 (6 if you count the top one as 2)
2. All nerve impulses are the same in principle. You could not distinguish which receptor they came from. The sensation you experience depends on which part of the brain the impulse is sent to.

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1. **d** receptor organ stimulated; **b** impulse travels in sensory fibre; **e** impulse crosses synapse; **a** impulse travels in motor fibre; **c** effector organ stimulated.
2. **a** Sneezing; sensors in the nose; effectors in diaphragm, rib muscles and muscles in the upper part of the trachea.
b Blinking; receptors in the retina of the eye; effectors, muscles in the eyelids.
c Contraction of the iris; receptors in the retina; effectors, circular muscles (sphincter muscles) in the iris.

3. The tongue has receptors for the chemicals which produce the taste sensations as well as sensors for temperature and pain. It is an effector because its muscles can move it about to manipulate food, initiate swallowing and control speech.
4. Coughing as a reaction to particles in the trachea or an intense 'tickle' is a reflex action. You cannot stop it. Coughing to clear the throat is a voluntary action.
5. Responses to commands such as 'lie down', 'come here', and to actions such as a lead being picked up or a plate being rattled are conditioned reflexes.

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1. The cell bodies are concentrated in the grey matter so this is where synapses will occur.
2. Depending on the extent of the damage; no sensory information (touch, pressure etc.) would reach the brain from the legs and lower abdomen. Motor function below the area of damage would be lost so that there could be no leg movement, and control over bladder and rectum would be lost.
3. **a** Fore-brain; *smell*. Mid-brain; *sight*. Hind-brain; *hearing, balance and skin senses*.
b The medulla.
4. Sensors in the cochlea of the ear detect the sound waves and send impulses via the auditory nerve to the hind-brain.
The hind-brain then transmits impulses via neurones and synapses to the cerebral cortex which, in turn, sends motor impulses to the neck muscles which turn the head.

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- | <u>Endocrine system</u> | <i>(Examples)</i> | <u>Nervous system</u> |
|--|-------------------|---|
| 1. Secretion of oestrogen.
Transport of oestrogen to ovary.
Rate of blood flow from ovary to pituitary. | | Spinal reflex.
Impulses from sensors to brain.
Impulse from sensor to brain takes milliseconds. |
| Oestrogen is carried to all parts of the body but affects only the uterus and pituitary gland.
Secondary sexual characteristics. | | Motor neurone in reflex arc sends impulse directly to effector organ.
Reflex response. |
| 2. The ovaries produce ova but they also secrete the hormone, oestrogen.
The testes produce sperms but they also secrete the hormone, testosterone. | | |
| 3. Too much insulin results in a reduction in the blood glucose level, which can impair the function of other organs such as the brain.
Too little insulin allows the blood glucose levels to rise. This effect and related effects can produce the symptoms of diabetes. | | |
| 4. If an ovum is fertilized, the ovary produces the hormone progesterone. This hormone or its breakdown products are excreted and appear in the urine, where they can be detected. | | |

Chapter 20 Personal health

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1. The answer will depend on personal data.
2. Dental decay. Avoid frequent or prolonged exposure to sugary substances.
Gum disease. Clean the teeth regularly to remove plaque.

1. Tolerance of a drug means that the user needs larger and larger doses to achieve the desired effect. Dependence means that the user has a craving for the drug and cannot give it up without experiencing distressing withdrawal symptoms.
Being 'hooked' on a drug means that the user is dependent on it.
2. **a** Athletics. Amphetamines raise the blood pressure to dangerously high levels.
b Examinations. Amphetamines increase confidence but not accuracy. You could be writing rubbish with confidence.
3. Alcohol causes vasodilation in the skin. The heat-gain sensors in the skin send impulses to the brain and induce a feeling of warmth. But the vasodilation also increases loss of heat from a warmer skin.
4. Alcohol increases reaction time so that it takes longer for the driver to react to a hazard though it also induces a false feeling of confidence.
5. There is a risk that morphine and heroin will lead to tolerance in users, so that the addicts have to constantly increase doses to get the desired effect.