IGCSE BIOLOGY • EXERCISE SHEET

14.1 Coordination and response

Name: _____ Class: _____ Date: _____ **Total: 28 marks**

KEY WORDS synapse 突触 • receptor 感受器 • reflex 反射 • neurones 神经元 • reflex arc 反射弧

Objective

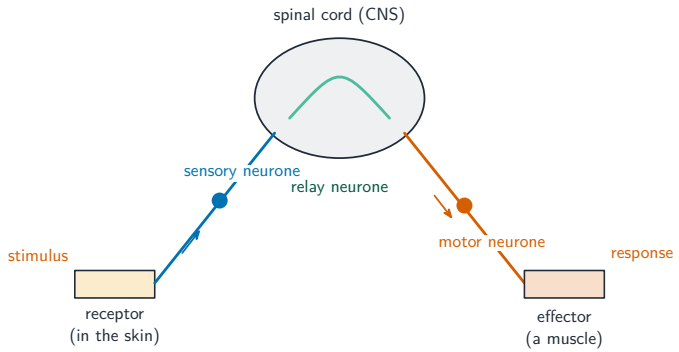
Build the skills to answer exam questions on **coordination and response** 协调与反应 — the **nervous system** 神经系统, the **reflex arc** 反射弧, and **synapses** 突触.

You must be able to:

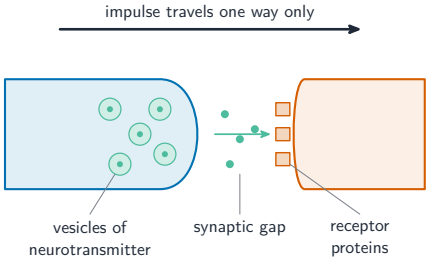
- name the parts of the nervous system and the three neurones
- describe a reflex arc in order
- describe how a synapse works and why impulses go one way

1 Worked examples

■ Reflex arc and synapse



Reflex arc: receptor → sensory neurone → relay neurone → motor neurone → effector



Neurotransmitter diffuses across the gap and binds receptors — impulses go one way only

- **CNS** = brain + spinal cord; **PNS** = the nerves.

■ The reflex arc, named in order, and what a synapse does

The **nervous system** 神经系统 splits into the **central nervous system (CNS)** 中枢神经系统 — the brain and the spinal cord — and the **peripheral nervous system**, the nerves that connect the CNS to the rest of the body.

Three kinds of neurone 神经元, learned as a chain: a **sensory neurone** 感觉神经元 carries the impulse from a receptor to the CNS; a **relay neurone** 中继神经元 passes it across inside the CNS; a **motor neurone** 运动神经元 carries it from the CNS to an effector.

The reflex arc, in the order the marks are given:

stimulus → receptor → sensory neurone → relay neurone → motor neurone → effector → response

A **reflex action** 反射作用 is fast and automatic because the impulse does not travel to the conscious part of the brain — the relay neurone in the spinal cord completes the circuit — which is what protects the body from damage in time.

A synapse 突触 is the junction between two neurones, with a tiny gap. The impulse arrives at the end of the first neurone; **neurotransmitter** 神经递质 molecules are released into the gap; they **diffuse** across and bind to **receptor proteins** on the next neurone's membrane; that starts a new impulse in the second neurone. The transmitter is released on one side only, so a synapse makes the impulse travel in **one direction only** — a mark in itself.

Worked example. Describe what happens between touching a hot plate and pulling the hand away. A temperature (pain) receptor in the skin detects the stimulus; a sensory neurone carries the impulse to the spinal cord; a relay neurone passes it to a motor neurone; the motor neurone carries it to the biceps muscle, the effector; the muscle contracts and pulls the hand away. The impulse does not go to the brain first, which is why the response is so fast.

2 Practice

2.1 Name the two parts of the central nervous system. [2]

2.2 State the job of a motor neurone. [1]

2.3 Name the three types of neurone in a reflex arc, in the order the impulse travels. [3]

2.4 Explain why an impulse can travel across a synapse in one direction only. [2]

2.5 State what is meant by an effector, and give one example. [2]

3 Exam-style questions

3.1 The correct order of a reflex arc is: [1]

A B
C D

A receptor → motor → relay → sensory → effector
B receptor → sensory → relay → motor → effector
C effector → motor → relay → sensory → receptor
D receptor → relay → sensory → motor → effector

3.2 A synapse joins two neurones.

(a) Describe how an impulse crosses a synapse. [3]

(b) Explain why a synapse makes impulses travel in one direction only. [1]

3.3 A person steps on a sharp stone and pulls the foot away before feeling any pain.

(a) Complete the sequence of the reflex arc. [3]

stimulus → **receptor** → _____ → _____ → _____ → effector → response

(b) Name the effector in this reflex and state the response it produces. [2]

(c) Explain why the foot is pulled away before the pain is felt. [2]

(d) Describe how the impulse crosses a synapse. [4]

(e) Explain the advantage of reflex actions to the body. [2]