

14.2 Sense organs

Name: _____ Class: _____ Date: _____ **Total: 25 marks**

KEY WORDS eye 眼 • cones 视锥细胞 • rods 视杆细胞 • retina 视网膜 • iris 虹膜

Objective

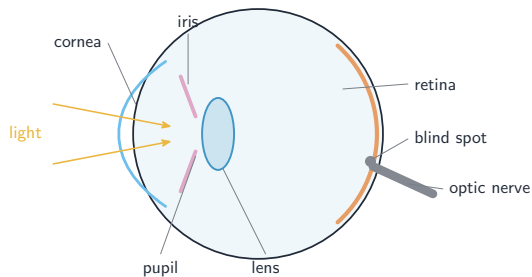
Build the skills to answer exam questions on **sense organs** 感觉器官 — the parts of the **eye** 眼, the **pupil reflex** 瞳孔反射, **accommodation** 视觉调节, and rods and cones.

You must be able to:

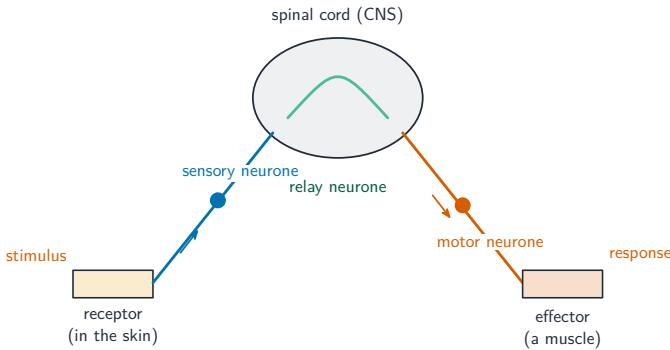
- name the parts of the eye and their functions
- explain the pupil reflex (antagonistic muscles)
- describe accommodation and the roles of rods and cones

1 Worked examples

■ The eye



Cornea and lens refract light onto the retina; impulses leave by the optic nerve



Sense organs feed the reflex arc

- **pupil reflex:** bright light → circular muscles contract → pupil narrows.
- **accommodation:** near object → ciliary muscles contract → lens fatter.
- **rods:** dim light (no colour); **cones:** colour, bright light.

■ The eye: which part does what, and the two reflexes

Part	What it does
cornea 角膜	transparent front; does MOST of the focusing (refracting)
iris 虹膜	coloured ring of muscle; controls the size of the pupil
pupil 瞳孔	the hole light passes through — not a structure but a gap
lens 晶状体	fine-focuses light onto the retina; changes shape
retina 视网膜	contains the light receptors (rods and cones)
optic nerve 视神经	carries impulses from the retina to the brain
ciliary muscle 睫状肌 and suspensory ligaments 悬韧带	change the shape of the lens

The pupil reflex. In **BRIGHT** light the **circular muscles** of the iris contract and the **radial muscles** relax, so the pupil gets smaller and less light enters — protecting the retina from damage. In **DIM** light the radial muscles contract and the circular muscles relax, so the pupil widens and more light enters. Naming which set of muscles contracts is the mark; “the pupil gets smaller” alone is not.

Accommodation 调节 — focusing on near and far:

	ciliary muscle	suspensory ligaments	lens
near object	contracts	slacken	fatter, more curved, refracts more
distant object	relaxes	pull tight	thinner, refracts less

Worked example. Explain what happens in the eye when a reader looks up from a book to a distant tree. The ciliary muscle relaxes; the suspensory ligaments are pulled tight; the lens is pulled thinner; it refracts the light less, which is what brings the distant object into focus on the retina.

△ The commonest error is to say the ciliary muscle *contracts* for a distant object. Learn the pair together: **near = contract = fat lens**.

2 Practice

2.1 State the function of the retina. [1]

2.2 State what happens to the pupil in bright light. [1]

2.3 Name the part of the eye that does most of the focusing. [1]

2.4 State which muscles of the iris contract in dim light, and the effect on the pupil. [2]

2.5 State what happens to the lens when the eye focuses on a near object. [2]

3 Exam-style questions

3.1 The part of the eye that focuses light onto the retina is the: [1]

- **A** iris
- **B** cornea only
- **C** lens
- **D** optic nerve

3.2 The pupil changes size in different light.

(a) Explain how the pupil narrows in bright light. [2]

(b) State the difference between rods and cones. [2]

3.3 A student walks from a dark room into bright sunlight and then reads a sign in the distance.

(a) Complete the table by naming the part of the eye that performs each function. [4]

Function	Part
contains the light receptors	
controls how much light enters	
carries impulses to the brain	
changes shape to fine-focus the light	

(b) Describe the pupil reflex that occurs as the student enters the sunlight, naming the muscles involved. [3]

(c) Explain the advantage of this reflex. [1]

(d) Describe the changes in the ciliary muscle, the suspensory ligaments and the lens as the student focuses on the distant sign. [3]

(e) The student then looks down at a book. State how the lens changes and explain why that change is needed. [2]

Solutions

2.1 it contains light receptors that detect light.

2.2 it gets smaller (narrows).

2.3 The cornea.

2.4 The radial muscles contract, and the circular muscles relax; the pupil becomes wider, so more light enters.

2.5 The lens becomes fatter, or more curved, so it refracts the light more.

3.1 C. The lens focuses light onto the retina.

3.2 (a) the circular muscles of the iris contract; the radial muscles relax, so the pupil narrows.

(b) rods are sensitive in dim light but detect no colour; cones give colour vision and work best in bright light.

3.3 (a) Retina; iris; optic nerve; lens.

(b) The circular muscles of the iris contract and the radial muscles relax; the pupil becomes smaller, so less light enters the eye.

(c) It protects the retina from being damaged by very bright light.

(d) The ciliary muscle relaxes; the suspensory ligaments are pulled tight; the lens is pulled thinner, so it refracts the light less.

(e) The lens becomes fatter or more curved; a near object needs the light refracted more to bring it to a focus on the retina.