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UPPER SECONDARY IP BIOLOGY

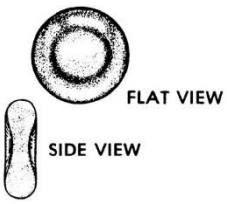
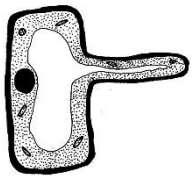
Cells, Homeostasis, Nervous System, Human Eye

RGS S3 WA2 revision

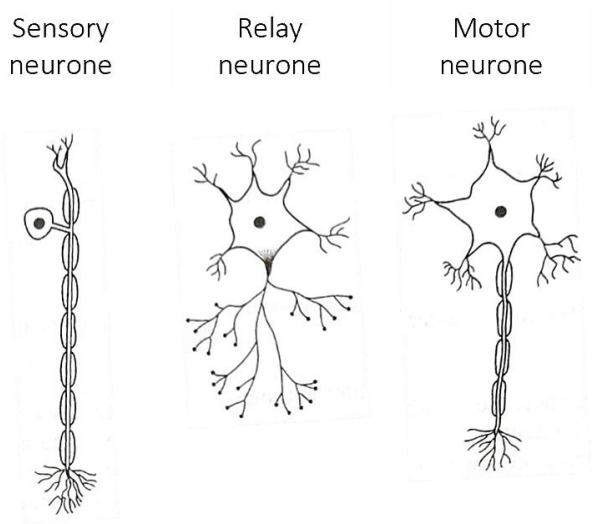
Name: _____

Date: _____

Specialised cells

Cell	Structure	Function
Red blood cell (Animal cell) 	Lack nucleus and other organelles	Allows red blood cells to pack more haemoglobin per cell to transport oxygen more efficiently around the body
	Circular, biconcave shape	↑ surface area to volume ratio for rapid diffusion of oxygen into or out of the cell
	Lack mitochondria	To ensure red blood cells do not respire the oxygen they are meant to transport
Intestinal epithelial cell (Animal cell)	Surface of each epithelial cell covered in small projections called microvilli	↑ surface area to volume ratio for efficient absorption of nutrients
Root hair cell (Plant cell) 	Long and narrow protrusion	↑ surface area to volume ratio for efficient absorption of water and mineral salts
	No waxy cuticle, concentrated cell sap	Provides a steep water potential gradient for greater rate of osmosis
	Contain numerous mitochondria	Provides energy required for active transport of ions into the cell
Xylem vessel (Plant cell) 	Long hollow tubes with no cross walls and protoplasm	Continuous and smooth passage of water to transport water and mineral salts
	Lignin deposit on walls	Supports the plant and prevents the vessel from collapsing

The Nervous System



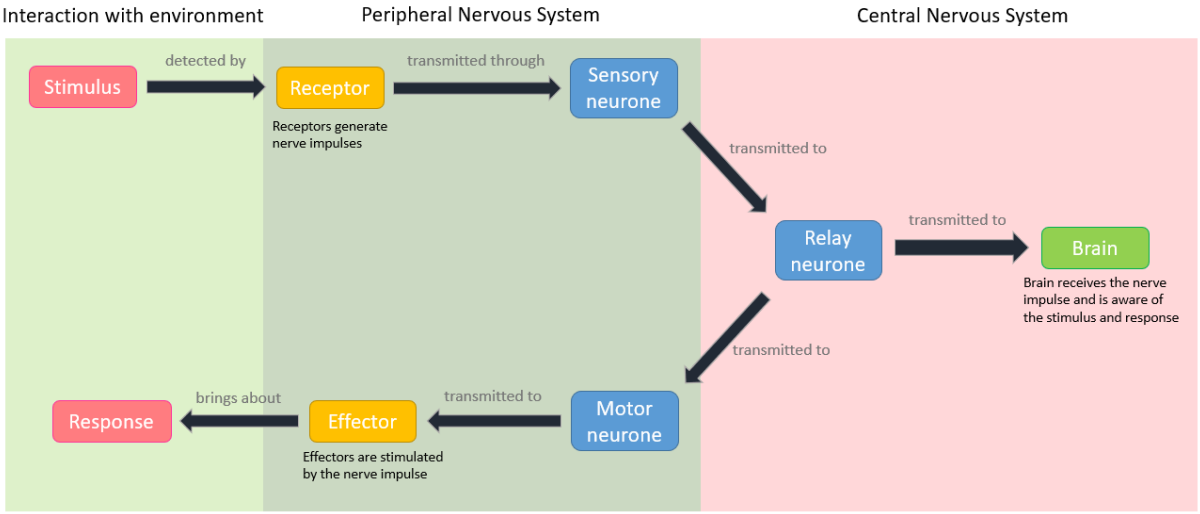
A reflex action is an **immediate response** to a **specific stimulus** without conscious control.

- Nerve impulses are transmitted through the reflex arc very quickly
- A reflex arc is the shortest pathway for nerve impulses to travel from receptor to effector

- Responses are specific and appropriate to the stimulus
- See food → salivate
- Feel pain → scream
- Dust in eye → blink

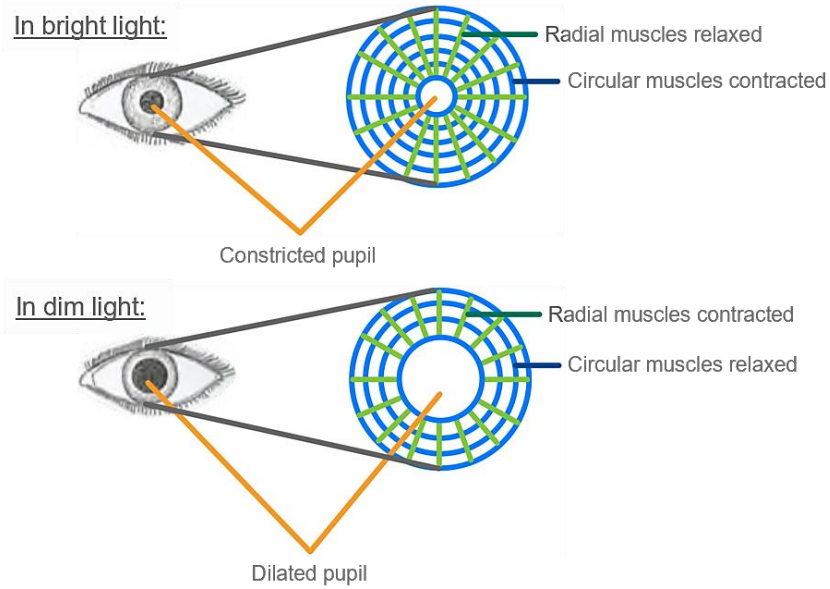
The brain does not need to actively process the information then send out nerve impulses for the action to occur

The shortest pathway for nerve impulses to travel from receptor to effector is the reflex arc and explains why reflexes occur so quickly.



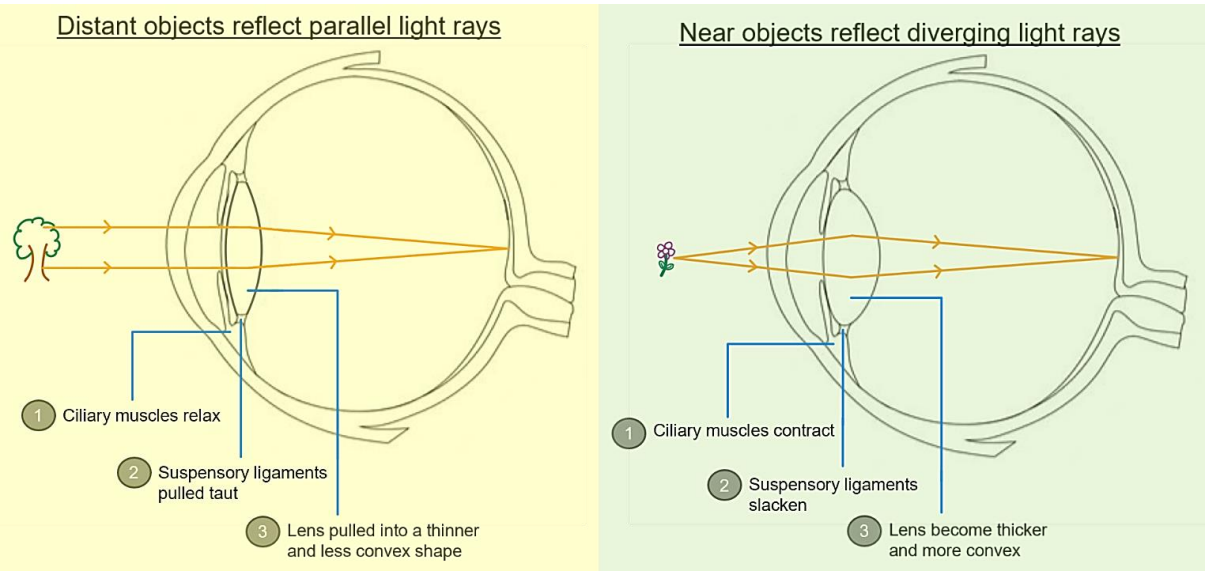
The Human Eye

The pupil constricts in bright light to reduce the amount of light entering the eye, protecting the retina from overstimulation.



The pupil dilates in dim light to increase the amount of light entering the eye, enhancing dim light vision.

The ciliary muscles and suspensory ligaments work together to change the shape of the lens, which increases or decreases the extent to which light rays are refracted. This fine adjustment allows the focal point to land directly on the retina for a clear image to form.



A thinner and less convex lens refracts light to a smaller extent while a thicker and more convex lens refracts light to a greater extent.

Homeostasis – thermoregulation

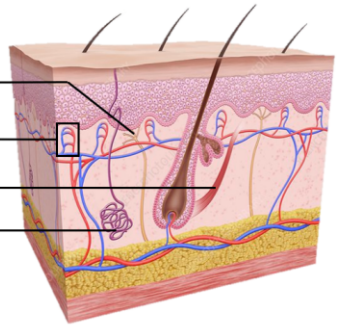
Thermoreceptors in the skin detect changes in skin surface temperature while thermoreceptors in the hypothalamus detect changes in internal body temperature. Being in an extremely warm environment or consuming warm food and drinks will stimulate several corrective mechanisms to bring body temperature down towards the norm.

Thermoreceptors in the skin detect an increase in skin surface temperature above the norm

Vasodilation of skin surface arterioles to increase the rate of heat loss via conduction, convection, and radiation

Hair erector muscle relaxes, causing hair to lie flat and trap a thinner layer of air around the skin

Sweat glands increase the rate of sweat production to increase the rate of heat loss when sweat evaporates



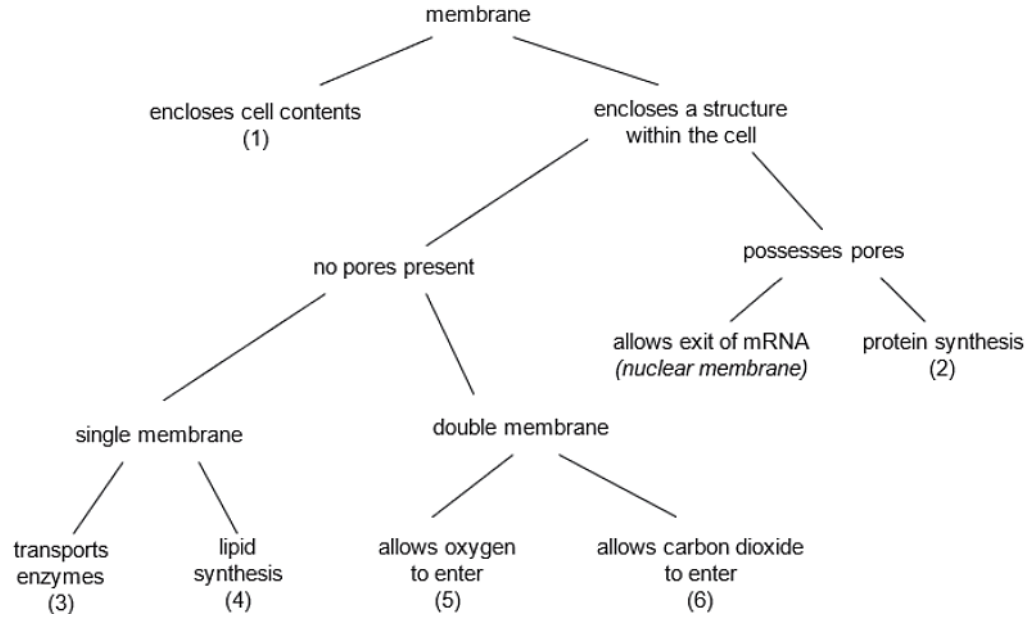
On top of the aforementioned corrective mechanisms, metabolic rate decreases to reduce the rate of heat production. Breathing rate increases to remove more heat via exhaled air.

Write your answers in the table below.

1	2	3	4	5	6	7	8	9	10

Question 1 [CWSS 2022 S4 Prelim P1 | Q7 - modified]

The endomembrane system of a cell performs a variety of functions which are different from the function of the cell surface membrane. The diagram below describes the differences and similarities in structure and function of these membranes.



Which row correctly matches the structures to the labelled numbers?

	(1)	(2)	(3)	(4)	(5)	(6)
(A)	Chloroplast	Vesicle	Smooth ER	Rough ER	Cell membrane	Mitochondrion
(B)	Cell membrane	Rough ER	Vesicle	Smooth ER	Chloroplast	Mitochondrion
(C)	Cell membrane	Rough ER	Vesicle	Smooth ER	Mitochondrion	Chloroplast
(D)	Cell membrane	Smooth ER	Mitochondrion	Rough ER	Vesicle	Chloroplast

Question 2 [CCHS (Y) 2022 S4 Prelim P1 | Q1 - modified]

Radioactively labelled amino acids were introduced into a healthy pancreatic cell. Which structure will the radioactivity first be detected at?

(A) Cell membrane

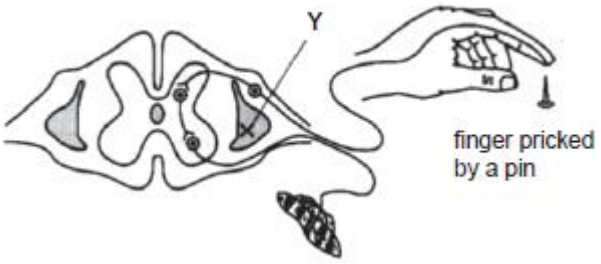
(B) Rough endoplasmic reticulum

(C) Golgi apparatus

(D) Nucleus

Question 3 [2022/S4/BBSS/PRELIM/P1/Q28]

The finger is accidentally pricked by a pin. The diagram shows part of the nervous system, including a reflex arc, which has been damaged along the line XY.

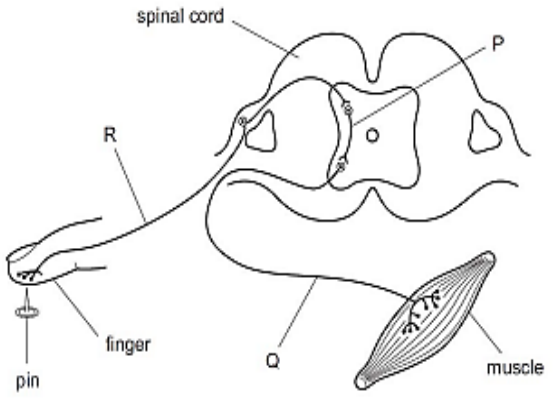


What are the effects of this pin prick?

	Pain felt	Arm moved
(A)	No	No
(B)	No	Yes
(C)	Yes	No
(D)	Yes	Yes

Question 4 [2022/S4/FCSS/PRELIM/P1/Q22 - modified]

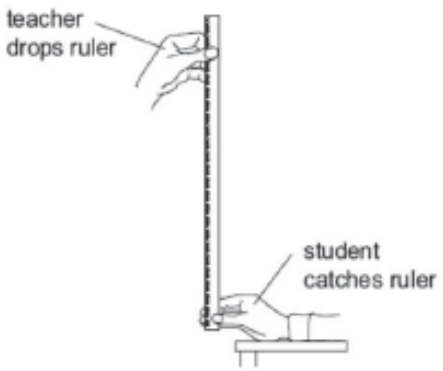
The diagram represents a simple reflex arc. In what sequence do nerve impulses pass through during a reflex action?



	First → Last		
(A)	P	Q	R
(B)	Q	P	R
(C)	R	Q	P
(D)	R	P	Q

Question 5 [2022/S4/CWSS/PRELIM/P1/Q23]

The reaction time of a student is determined by measuring the distance a ruler falls before it is caught by the student. A teacher drops the ruler as shown.



Which path is taken by nerve impulses from the student's eyes to the muscles of his hand?

(A) optic nerve → retina → spinal cord → brain → spinal nerve

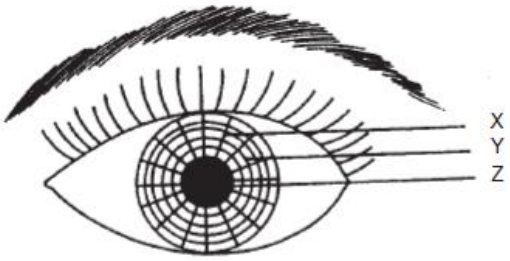
(B) optic nerve → retina → spinal cord → spinal nerve → brain

(C) retina → optic nerve → brain → spinal cord → spinal nerve

(D) retina → optic nerve → spinal nerve → brain → spinal cord

Question 6 [2022/S4/SCGS/PRELIM/P1/Q25]

The diagram shows a front view of the eye with labelled parts X,Y and Z.



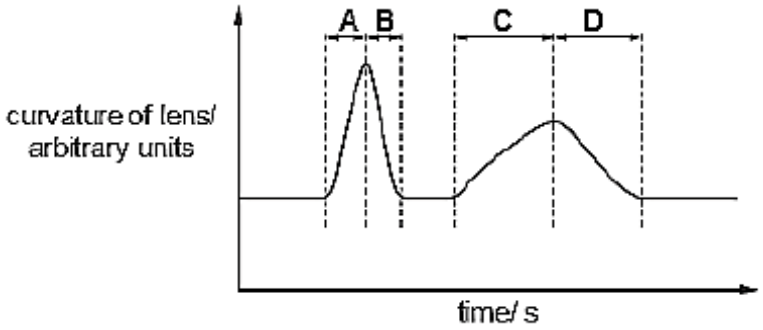
Which row correctly shows what happens when a person walks from a dark room into a bright room?

	X	Y	Z
(A)	Contract	Relax	Constrict
(B)	Relax	Constrict	Contract
(C)	Contract	Relax	Dilate
(D)	Relax	Contract	Constrict

Question 7 [2022/S4/BSS/PRELIM/P1/Q27]

The diagram shows the curvature of the lens in a person's eye.

During which period was a motorbike moving towards the person at a higher speed?



Question 8 [SCGS 2022 S4 Prelim P1 | Q18 - modified]

Which statement best describes negative feedback?

(A) A change away from a set point causes a change back towards the set point.

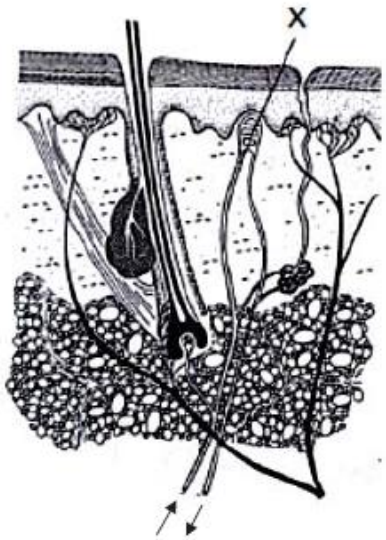
(B) A change away from a set point causes a change to a new set point.

(C) A change towards a set point causes a change away from the set point.

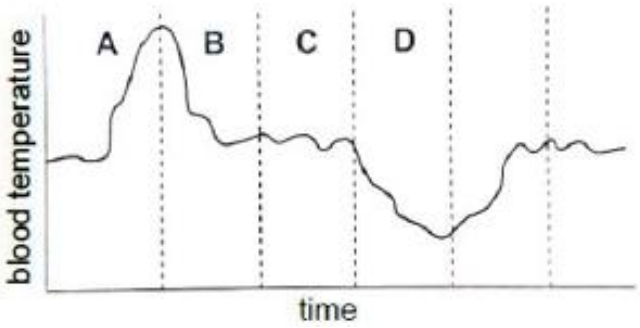
(D) A change towards a set point is prevented.

Question 9 [BSS 2022 S4 Prelim P1 | Q23 - modified]

The diagram below shows a section through the human skin.



During which period of time in the graph below will the muscles in X contract?



Question 10 [CVSS 2022 S4 Prelim P1 | Q22 - modified]

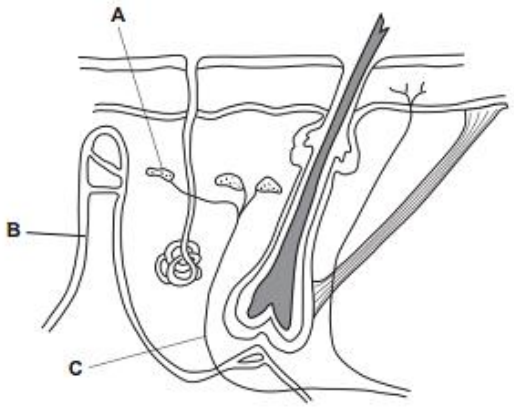
Organisms native to hot and dry deserts have adaptations that help them survive in those harsh conditions. Which of the following features are appropriate for a desert mouse?

	Sweat glands	Collecting ducts	Amount of ADH released
(A)	More	Shorter	Less
(B)	More	Longer	More
(C)	Less	Shorter	Less
(D)	Less	Longer	More

Write your answers in the spaces provided.

Question 11 [SCGS 2022 S4 Prelims P2 | Q1 - modified]

A section of the human skin is shown in the diagram below.



(a) Identify and state the roles of structures A and C in thermoregulation. [4]

(b) Hikers used to drink alcohol to keep themselves warm when they were high up in the mountains because it made their faces blush and feel warm to touch. Research now shows that alcohol consumption at extremely low temperatures results in a greater rate of heat loss.

Based on your understanding of structure B, suggest how this is so. [3]

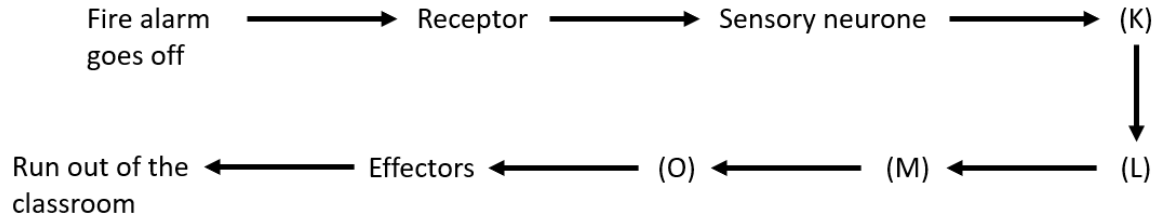
(c) (i) On the diagram above, label structure D, a muscle that contracts when body temperature decreases below the norm. [1]

(ii) Describe how structure D contracting is useful when body temperature decreases below the norm. [2]

Question 12 [MGS 2022 S4 Prelims P2 | Q6 - modified]

Adam was alone in the classroom reading a book. Upon hearing the fire alarm, he sprinted out of the classroom. When he got to the field, he was trembling, and his heart rate was 160 bpm (beats per minute). He managed to calm himself down 5 minutes later.

The diagram below shows the nervous pathway for his response.



(a) (i) This pathway passes through K and L which are tissues or organs associated with the nervous system. Identify K and L. [2]

K: _____

L: _____

(ii) State whether Adam's response was a reflex action or a voluntary action. Use the transmission of the nerve impulses through the diagrams above to explain your answer. [4]

_____

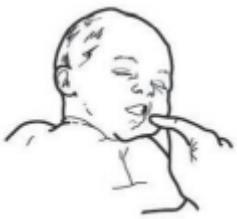
_____

_____

_____

_____

(b) Newborn babies have a rooting reflex where they turn their heads towards the corner of their mouth or cheek that is stimulated.



This is a reflex action that helps them better latch and nurse with their mother.

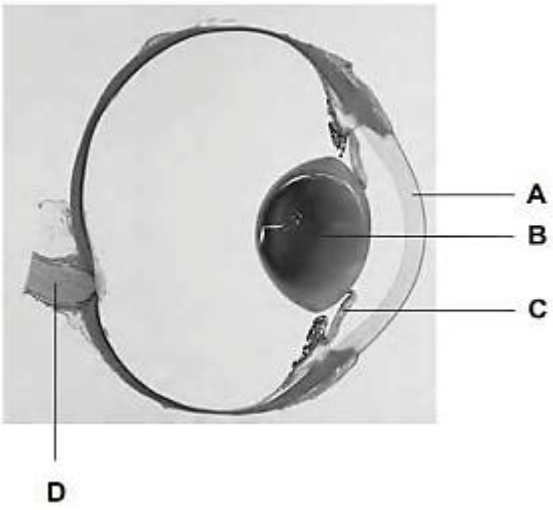
State and explain if the rooting reflex or Adam's response occurs more quickly. [2]

_____

_____

Question 13 [SJI 2022 S4 Prelims P2 | Q4 - modified]

The diagram below shows a photograph of a section through a human eye.



(a) Identify the labelled structures. [2]

A: _____ C: _____

B: _____ D: _____

(b) Describe how relevant structures in the human eye produce a focussed image of a distant object. [4]

_____

_____

_____

_____

_____

_____

(c) Based on the photograph, suggest how this person's vision may be impaired. [2]

_____

_____

_____

_____