

FORM 4

BIOLOGY

TOPIC 3: RECEPTION, RESPONSE AND COORDINATION IN PLANTS AND ANIMALS.

1. Name the type of response shown by:

a). Leaves of Mimosa pudica when they fold after being touched.

Nastic/ hyponasty / thigmonosty.

b) Sperms when they swim towards ovum. **Positive chemo taxis.**

c) Euglena when they swim towards the source of light. **Positive photo taxis.**

2. Explain how structures of the human ear are adapted to their functions.

The pinna;- is funnel shaped; cartilaginous structure that collects and directs sound waves into the ear; **The external auditory canal**; - a tube that directs sound waves from the pinna to the eardrum lining the auditory canal; The canal contains wax-secreting cells; and hair which traps dust particles; and pathogenic bacteria hence prevent them from getting into the ear; **The eardrum**; - has a thin tough membrane; that easily vibrates when hit by sound waves; transferring them into vibrations.

The ear ossicles; - they act like a lever and they easily move forward and backward to amplify sound vibrations that hit them;

The suspensory ligaments; - suspends the ear ossicles and prevents excessive vibration that would otherwise damage the inner parts of the ear; **The eustachian tube** - it connects the middle ear with the pharynx; and it equalizes air pressure between the middle and the outer ear so as to prevent distortion of the eardrum;

The oval window; - has thin membrane that transmits sound vibrations into the endolymph;

The cochlea; - highly coiled to occupy a small area but to accommodate a large number of sensory cells;

The perilymph and endolymph; - these are fluids that absorb mechanical shock; hence protect the delicate parts in the inner ear; they also transmit vibrations to the inner parts of the ear;

The sensory cells; - when stimulated, they generate nerve impulses; which are transmitted by the auditory nerve to the brain;

The semi-circular canals; - these are tubular cavities that maintains body balance and posture; they contain special cells that are sensitive to changes in gravity;

3. State the changes that occur in a nerve axon to produce an action potential.
Action potential: When an impulses passes along the axon, the membrane of the axon becomes depolarized to sodium ions thus they diffuse into the axon; the inside of the axon, becomes positively charged relative to the outside and action potential is generated.

4. State one function of each of the following parts of a mammalian ear. a)
Pinna

It collects and concentrates sound waves to the auditory meatus. b)

Tympanic membrane

Thin tough membrane that transforms sound waves into vibrations. c)

Vestibule

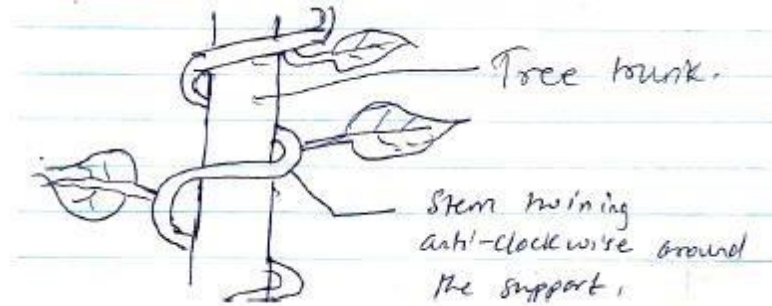
Consists of utricle & Sacculus that have sensory cells.

5. State one structural and one functional difference between motor and sensory neurones.

- Structural difference – **The cell body in motor neurone is terminal (at the end) and inside the central nervous system. While the cell body in sensory neurone is not terminal but has axon on both end i.e. bipolar.**

- Functional difference - **Motor neurone carries impulse from central nervous system to the effectors i.e. muscles while sensory neurone carry impulse form receptor to the central nervous system.**

6. The figure below shows a stem of a plant growing round a tree trunk



a). What is the name of the response which causes such a twisted growth?

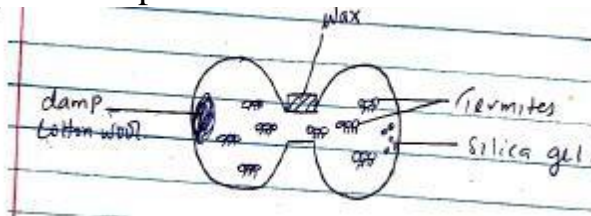
Thigmotropism/haptotropism

b) Explain how twisting process is accomplished

The part of the stem in contact with the tree trunk has lower auxin content than the outer part;

High concentration of auxin on the outer part away from the plant promotes faster growth of this side causing the stem of the plant to grow or coil round the tree trunk.

7. The set up below was used to demonstrate a certain behavior of termites



a) State the function of the following in this experiment

i) Damp cotton wool

To create a moist environment;

ii) Silica gel

-Absorb water and create a dry environment; iii)

Wax

Make apparatus air tight.

b) What results were obtained from this experiment after 12hrs?

Majority were found in the chamber with moist cotton wool c)

Account for the results in (b) above

The termite have moved to the chamber with moist to avoid dehydration d)

Name the type of response shown by termites.

Tactic response

e) What material would be missing in a control experiment?

-Silica gel;

-Cotton wool

8.(a) Name two types of light sensitive cells found in the human eye.

Rods and cones;

(b) State ONE functional difference between the cells you have named in a) above.

Rods:

Perceives light of low intensity;

- Are not sensitive to color

- Have low visual acuity;

Cons

- Perceives light of high intensity;

- Are sensitive to color;

- Have high visual acuity

9. State the functions of the following parts of the mammalian ear.

a) Eustachian tube

It balances pressure in the middle ear with that of the atmosphere to prevent distortion of the ear drum;

b) The utricle and sacculus

Maintenance of body balance and posture in relation to gravity;

10. In an experiment, a shoot of maize seedling was exposed to light on one side. It was observed that it grew bending towards the direction of the source of light. a) Explain how the bending towards light occurs.

Light causes lateral migration of auxin to the dark side; where high concentration of auxin stimulates rapid cell elongation and faster growth hence the shoot bends towards light;

b) State the survival value of the response named in a) above. **It enables plant shoots to grow towards light for photosynthesis.**

11. How is the human eye adapted to its functions?

- **Conjunctiva** – Thin/transparent/tough; allow light to pass through/protect the eye;
- **Sclerotic layer** – Is made up of (collagen) fibres/fibrous; It maintains shape of eye (ball)/protect the eye.
- **Choroid** – (Is a layer of tissue) with black/dark pigments; Prevents internal reflection of light in the eye; Contains blood vessels; that supply oxygen/nutrients/remove (metabolic) waste from the eye;
- **Cornea** – Is transparent/curved; thus refracts light rays/allows light to pass through;
- **Retina** – Has rods/cones for colour/bright light vision and rods for low light vision;
- **Fovea/Fovea centralis/yellow spot** – has high concentration of cones for accurate vision/visual acuity;
- **Blind spot** - Has no cones and rods; place where optic nerves leaves/enters the eye;
- **Optic nerve** – Has sensory nerve fibres/neurons; for transmission of impulses to the brain (for interpretation);
- **Lens** – Is biconvex /made of elastic/transparent material; adjust to focus for a near object/accommodation/allow light to pass through/for refraction of light rays;
- **Ciliary body** – Is made up of muscle fibres/glandular; which contracts/relax; to change shape/curvature of lens/produces aqueous humour;
- **Suspensory ligaments** – Are elastic; hold lens in position/attach it to ciliary body;
- **Iris** – Has radial and circular muscles; which control the size of the pupil;
- **Pupil** – Is the hole at the centre of iris; through which light passes into the eye;
- **Aqueous humor** – Is a fluid/transparent/clear; through which oxygen/nutrients pass to cornea/lens/maintain shape of eye (ball) refracts light rays/allows light to pass through;
- **Vitreous humor** – Is a fluid/transparent/clear; which maintain shape of eye/refracts light rays/allows light to pass through;

12. State **one** adaptation of the following parts of mammalian eye. (i)

Fovea centralis.

Have high concentration of cones for visual acuity;

(ii) Sclera

Have tough collective tissues which help to support and protect other parts of eyeball;

(iii) Ciliary body

Have ciliary muscles whose contraction and relaxation alters the tension exerted on suspensory ligaments; thus the curvature of lens.

13. A climbing plant twines around the stem of a tall tree.

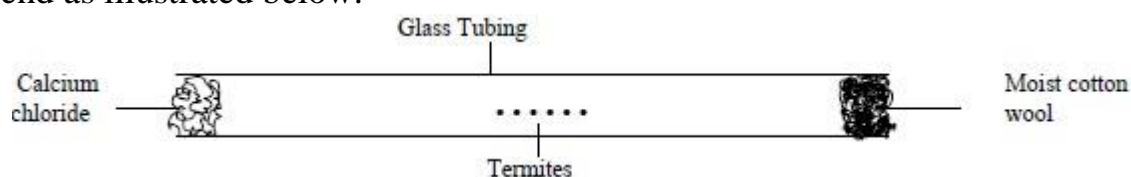
(i) Name the type of response exhibited by the climbing stem.

Thigmotropism; / Haptotropism;

(ii) Explain how the response named in (i) above takes place.

Contact with tree cause auxins to migrate to the part away from contact causing faster growth / on that side away from contact hence the plant tines around the stem.

14. An experiment was carried out to investigate the response of white termites to a certain stimulus. Ten termites were placed at the centre of glass tubing. Calcium chloride was placed on one end of the tubing and moist cotton wool at the other end as illustrated below.



a. What observations are made after 20 minutes?

Most of the termites will have moved towards the end with moist cotton wool.

b. What type of response is exhibited by the termites? **Negative chemotaxis / positive hydro taxis.**

c. What is the survival value of the above response?

Enable them escape from harmful stimulus / enable them find water;

15. What is Photo nasty?

Unidirectional movement of parts of plants in response to changes in light intensity;

16. Highlight **two** survival values of tropic response.

-Phototropisms expose the leaves in position to maximize light absorption thereby enhancing photosynthesis

-Hydrotropism enables the roots of the plant to seek water important in biochemical processes in plants.

-Haptotropism enables the plants obtain mechanical support, especially in those plants lacking woody stems.

-Geotropism enables plants roots to grow deep into the soil thus offering firm anchorage;

-Chemotropism enables the pollen tubes too grow towards the embryo sac thereby facilitating fertilization;

17. What is a klinostat?

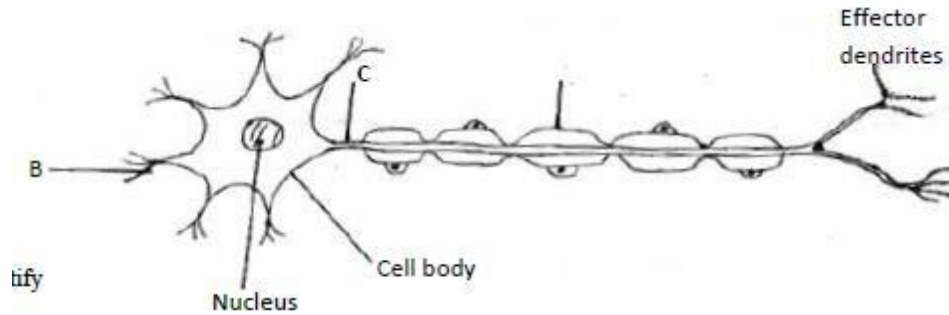
A device/instrument which slowly rotates a plant to nullify the effect of unidirectional stimulus;

18. Name the structure in cockroach used for detecting stimuli.

Cerci/circus;

19. Name the growth movement of part of plants in response to a unidirectional external stimulus. **Tropic (response);**

20. Study the diagram **below** of a neurone in human being.



a). Identify the neurone.

Motor;

b) Name the parts labeled. A and B

A: Myelin sheath;

B: Dendrite;

21. Explain tropic responses in plants and their survival values.

Phototropism

This is a growth curvature in response to direction and intensity of light

Shoots are positively phototropic while roots are negatively phototropic

Chemotropism

This is a growth curvature in response to a gradient of chemical concentration; developing pollen tubes grow towards chemicals secreted by the embryo sac;

Geotropism

This is a growth curvature in response to gravity; Shoots are negative geotropic while roots are positively geotropic;

Hydrotropism

This is a growth curvature in response to water/moisture; Roots are positively hydrotropic;

Thigmotropism

This is a growth curvature in response to contact with solid objects; shown by tendrils/climbing stems which twine around objects;

Survival values of tropic responses

-Phototropism exposes the leaves in position to maximum light absorption thereby enhancing photosynthesis;

-Chemotropism enables pollen tubes to grow towards the embryo sac to facilitate fertilization;

- Geotropism enables plant roots to grow deep into the soil thus offering firm anchorage to the plant;
- Hydrotropism enables the roots of the plant to seek water;
- Thigmotropism enables the plants to obtain mechanical support, especially plants lacking woody stems;

22.i) Explain why insectivorous plants trap and digest insect

To obtain nitrogenous compounds/nitrates; since they grow in substrates deficient of nitrogenous compounds ii) Name the type of response in (i)

above

Chemonasty/Chemonastic

23. State the importance of thigmotropism.

- **Provide support to tendrils**
- **Enable weak plants to have leaves exposed to light energy for photosynthesis**
- **Have their flowers exposed to pollinating agents**
- **Have their seeds and fruits to dispersal agents**

24. Chloroplasts in a palisade cell move away from extreme light intensity. Name the type of response by the chloroplast.

Phototaxis;

25. State the components of peripheral nervous system.

Sensory neurone; motor neurone

26. Give a reason for the presence of white matter in the central nervous system.

Axons of sensory and motor neurons are myelinated and found in the part hence white;

27. What are the roles of each of the following on transmission of impulses: i) Nodes of Ranvier

Propagates and speed up impulse transmission

ii) Myelin Sheath **Insulates the axon**

28. Name **two** functions of the mammalian ear.

-Hearing

-Body balance and posture

29. For each of the structures of the mammalian ear below, state its function.

(i) Auditory meatus

Transmission of sound waves into the eardrum (ii)

Eardrum

Vibrates and amplify soundwaves

(iii) Eustachian tube

Balancing the pressure

(iv). Ear ossicles

Regulates the position of the head and body posture

(v) Cochlea

Contains perilymph which moves on detecting vibration transmitting stimulus to the receptor cells.

30. Name a defect caused by damage of the cochlea of a mammalian. **-Permanent deafness.**

31. Name two main mineral ions required for transmission of a nerve impulse.

Sodium;

Potassium;

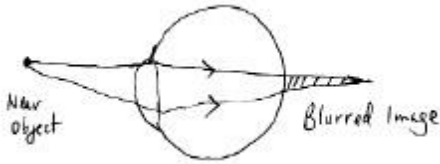
32. Name an old age disease associated with the following body organs .

(a) Eye

Presbyopia;

(b) Ear
Presbycusis

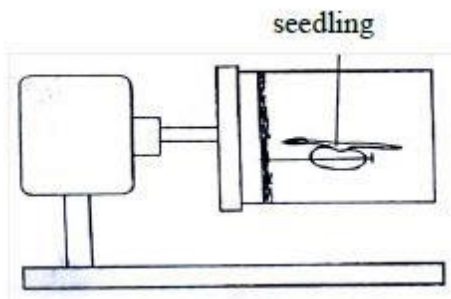
33. The diagram below represents an eye defect.



Name the above eye defect.

Long sightedness/Hypermertopia;

34. The diagram below shows a bean seedling pinned in a klinostat. Study the diagram and then answer the question that follows.



Account for the observation made after 48 hours with the klinostat moving.

Both the root and the shoot would continue growing horizontally ; this is because the rotating klinostat ensured that all sides of the root and shoot got uniform exposure to gravity ; There was therefore uniform distribution of auxins ; causing a corresponding uniform growth on all sides of root and shoot ;

35. State **three** defects of the eye and how each can be corrected.

- Myopia / short sightedness; corrected by using biconcave / diverging lenses.

- **Hypermetropia / long sightedness; corrected by Biconvex / converging lenses;**
- **Astigmatism; corrected by use of cylindrical lenses with combined curvature**

36. Which structure in the ear detect:


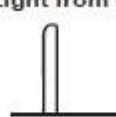
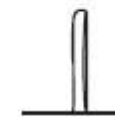

i) Change in posture

Semi-circular canal; ii)

Sound waves.

Cochlea;

37. In an investigation, young plant shoots were exposed to 48hrs of light from above or from one side only. Their growth responses are shown in the diagrams below.

	Shoot A Light from above	Shoot B Light from oneside only
At start		
After 48 hours		

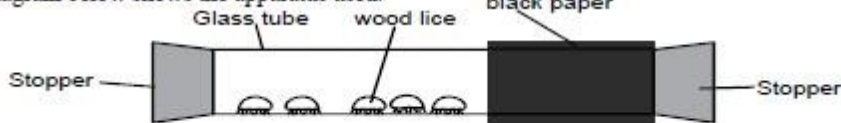
i).Name the response shown by the shoots and explain the advantages of this response to the plants.

Positive phototropism allows plant shoots to obtain optimum light for photosynthesis ii) Account for the growth response of **shoot B** after 48 hours.

Light causes lateral migration of auxins to the darker side; the darker side has a higher auxin concentration than the light side, cells on the darker side grow and elongate faster causing the curvature towards light;

38. An experiment was set up to study the response of woodlice to light. Ten woodlice were placed in a glass tube. After five minutes one end of the tube was covered with black paper to make it dark. The number of woodlice in light and dark was then recorded every minute for five minutes.

The diagram below shows the apparatus used.



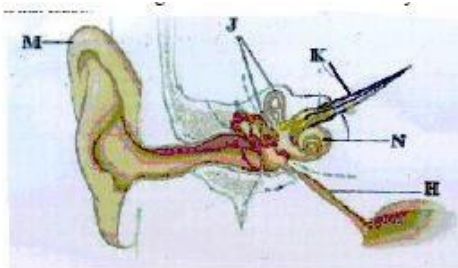
The table below shows the results of the experiment.

Time		0	1	2	3	4	5
Number of woodlice	In light	5	6	4	3	2	1
	In darkness	5	4	6	7	8	9

Why the woodlice left were there for five minutes before the pack paper was placed on the tube?

-To allow time for random distribution / uniform distribution of the woodlice;

39. The diagram below represents a section through the mammalian ear. Study it and answer the questions that follow.



a).Name the structures labelled H and J.

H - Eustachian tube; J - Semi - circular canals;

b).State how the structures labelled H, M and N are adapted to their functions. H, M, N

H - Opens during swallowing, yawning, chewing and vomiting to equalize air pressure in the middle ear with the atmospheric air pressure since it is open on both ends.

M - Curved / funnel shaped to receive or collect and concentrate / direct sound waves into the auditory meatus;

N - Long / highly coiled / spiral to increase surface area for attachment of sensory cells that bring about hearing;

c).State what would happen if the structure labelled K was completely damaged?

Total deafness

d).Name the fluid contained in structure N.

Endolymph

40. Apart from hearing, state the other role performed by the human ear.

-Maintains body balance and posture.

41. Define irritability, stimulus and response irritability

-also called sensitivity

- Responsiveness to change in environment

Stimulus

A change in the environment of organism which causes change in organism's activity

Response

- Change in activity of an organism caused by a stimulus

42. State importance of irritability to living organisms.

- Adjusting to environmental conditions. Sensitive/defect/responding

43. List the examples of external stimuli to organisms

- Air/oxygen (aero)

- Light (photo)

- Osmotic pressure (osmo)

- Current (Rheo)

- Chemical concentration (chemo)

- **Water/moisture (hydro)**
- **Touch/contact (hapto/thigmo)**
- **Gravity/soil (geo)**
- **Temperature (thermo)**

44. What are tactic responses?

- **Response in which whole organism or its mobile parts move e.g. gamete.**

45. What causes tactic responses?

- **It is caused by unidirectional stimulus but does not include growth.**

46. State the importance of tactic response to the members of kingdom protocista and the microscopic plants.

Members of kingdom protocista

- **Move towards favorable environment/move away from unfavorable environment.**
- **Move towards their prey/food.**

Microscopic plants.

- **Escape injurious stimuli/seek favorable habitats.**

47. Name the type of response exhibited by:

i).Euglena when they swim towards the source of light

- **Photo taxis** ii).Sperms when they swim towards the ovum

- **Chemo taxis.**

48. State the advantages of tactic responses to organisms.

- To avoid unfavorable environment/injurious stimuli
- Escape from predators
- To seek favorable environment
- To seek for food/prey

49. Define the term tropism.

- **Growth movement of plants in response to external unilateral/unidirectional stimuli.**

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50. State the ways in which tropisms are important to plants

- **Expose leaves/shoots in positions for maximum absorption of sunlight for photosynthesis.**
- **Enables roots of plants to seek/look/search for water.**
- **Enables plant stems/tendrils to obtain mechanical support especially those that lack woody stems.**
- **Enables roots to grow deep into the soil for anchorage.**
- **Enables pollen tube grow to embryo sac to facilitate fertilization.**

51. State the differences between tropic and tactic responses.

Tropisms	Taxes
<ul style="list-style-type: none"> - growth curvature in response - slow - influenced by hormones 	<ul style="list-style-type: none"> - locomotory response - fast - external influence