REVISION QUESTIONS ON BEHAVIOUR IN ANIMALS.

1. (a)With **relevant** examples, explain the meaning of each of the following forms of behavior.

Behavior form	Meaning	Examples
(i)**Habituation**	*Is a simplest form of learning in which repeated exposure/ subjecting an organism to same stimulus results in decreased response.*	*-snail crossing the board withdraws into its shell on hitting the board strongly; repetition of this action, the snail ignores the stimulus.* *-scare crow usually make birds avoid rice gardens for a few days but later become habituated to it; with even landing on them when feeding.* *-on touching the crown of tentacles of pea cock worm, it jerks back into its tube; and on continuous touching, the worm stops responding it.* *-species of animals relying on alarm calls to convey information about predators, stops giving alarm calls once familiar with other species in their environment that are not harmful.* *-A police horse ignores the loud noise of traffic and bustling crowd because it is habituated to noise as part of training.* *-Goat tied along road side ignoring passersby.*
(ii)**Imprinting**	*Is a rapid form of learning; in which an animal shortly after birth(hatching)/ during receptive/ critical period of life; recognizes and establishes a long lasting response to a specific individual(usually their parents)/ some large object in its environment.*	*-Nestlings respond to their parents' calls shortly after birth.* *-Newly hatched salmon learns the complex mixture of odours associated with the stream in which they hatch.* *-Goslings and ducklings become attached to a specific individual they interact with during their critical period of life.*
(iii)**Instinctive behavior**	*A complex inborn stereotyped behavioral pattern; characteristic of a species; occurring in response to a specific environmental stimulus; for the first time an individual is exposed to that stimulus.* **NB**. Stereotyped implies same response is given to same stimulus on different occasions;	*-Nest hygiene behavior in bees; where when a bee dies in a hive; a worker bee picks it up and carry it out, essentially throwing it away;* *-Hungry herring gull chicks peck repeatedly at the tip of a parent's bill until the parent regurgitates food.* *-Newly hatched sea turtle on a beach; moves automatically towards the ocean.* *-Marsupials climb into its mother's pouch upon being born.* *-Honey bees dance in the direction of a food source without formal instruction.* *-A bird building a nest* *-A spider spinning its web* *-Human babies crying to express pain, distress, and hunger; grasping response with hands by human babies exploring the surrounding.* *-Search for food by an animal in response to hunger*

(b) State the benefits of each of the above forms of behavior to animals.

(i) **Habituation**.

- *Animals avoid wasting time; and energy; responding to harmless stimulus that do not threaten their survival and reproduction;*
- *Filters large amounts of information from the environment; allowing animal's nervous system to focus on stimulus that signal food, mates, or real danger, beneficial for its survival;*

ii) **Imprinting.**

- *Allows migratory salmon fish trace their way back to fresh water streams to spawn.*
- *Effective communication between parents and the young.*
- *Young rapidly acquire survival skills form their parents.*
- *Prevents breeding between different species.*
- *Allows the young animals avoid predators as they tend to avoid those not imprinted to.*
- *Offers parental protection to the young during early stages of life. e.g. shortly after birth, a mother goat is sensitive to the smell of its kid.*
- *Song development in birds.*

iii) **Instinctive behavior**.

- *Protection of the young*
- *Promotes survival of organisms having short life cycles; because it provides the organism with readily made set of behavior response.*
- *Allows animals to fight to be in charge.*
- *Allows animals choose mates.*
- *Allows animals form groups for protection from danger.*

2. (a) (i) Distinguish between **territoriality** and a **territory** as used in behavior.

Territoriality *is the defense of an area of a habitat occupied by an animal or group of animals from others of the same species; while a* ***territory*** *is an area of a habitat(portion of a home range) that an animal or group of animals defend from others of the same species*.

(ii) Give **two** examples of animals that commonly display territorial behavior.

Antelopes; agama lizard; birds; monkey; lions; dogs.

(b) Territoriality in most animal species is accompanied by acts of aggression or signals. Outline how signals are used by different animal species in territoriality.

- *Threat postures in male robins*
- *Croaking in toads;*
- *Roaring in bull alligators;*
- *Use of solid wastes in hippopotamuses;*
- *Urination in cats;*
- *Waving claws in fiddler crabs;*
- *Singing in many bird species;*
- *Release of pheromones in insects;*

(c) What are the **advantages** and **disadvantages** of territorial behaviour?

Advantages

- *Optimum utilization of the habitat, as it ensures that each mating pair of organisms and their offspring are adequately spaced to receive a share of the available resources e.g. food and breeding space.*
- *Actual fighting between organisms which would be detrimental to the species is rare and replaced by mere threats, gestures and postures.*
- *Reduces over aggression between a community of the same species.*
- *Strengthens and maintains bond pairs by associating the animals within a territory.*
- *Reduces spread of diseases as contact between animals within a territory and outside population is reduced.*
- *Guarantees food to the young by keeping off all other animals that would feed on it.*
- *Limits mating to only fit individuals; thus genes from the more fit individuals are passed to the off springs; increasing on overall fitness of the population.*
- *Permits improved defense of nests, nestlings, and adults.*
- *Reduces intraspecific competition for available resources e.g. food and space.*
- *Associated with intraspecific competition; thus acting as a means of regulation population size*;

Disadvantages

- *Weak members fail to mate;*
- *Encourage less hybrid vigor by encouraging inbreeding;*
- *Associated with aggression and conflict;*
- *Territorial defense consumes time; and energy;*
- *Territorial defense interferes with breeding, courtship, mating and rearing of young ones;*
- *Members guarding a territory are at risk of predation, when using visual or vocal communication;*
- *Extra vigilance is required at certain time of the year e.g. breeding season;*
- *Difficult for smaller animals to hold territory i.e. more likely to be attacked than animals*;

3. (a) What is meant by the following;

(i) **Learning**

An adaptive change in an organism's behaviour resulting from past experience;

(ii) **Generalisation**

Phenomenon in which an animal habituated to a particular stimulus, usually treats another stimulus in the same way;

e.g. A horse habituated to one particular noise tends to habituate to a new noise more quickly;

(b) Distinguish between **learnt** and **instinctive behavior**.

Learnt behavior	**Instinctive behavior**
Acquired during an animal's life time.	*Inborn / inherited and not acquired during an animal's life time*
Easily and rapidly adapted to suit changing circumstances	*Fixed and not adaptable*
Vary considerably among different members of the same species.	*Similar among members of the same species.*
Intelligent; and the animal appreciates the function of particular action	*Unintelligent; and there is no appreciation of functions of behavior*
No fixed sequence of actions; i.e. completion of one does not affect the one that follows	*Fixed sequence of actions i.e. completion of one triggers the next.*
Short lived and temporary	*Permanent with minor modification*
Ranges from simple taxes or imprinting to complex forms of intelligence and reasoning	*Same for all organisms*

(c) Outline **two** factors that influence instinctive behavior.

- *Genetic control/ heredity;*
- *Interaction with the environment/environmental factors;*

(d) Give **two** ways in which animals avoid predation.

- *Mechanical protection e.g. shells in tortoise and snails; spines to prick predators e.g. porcupines.*
- *Group protection e.g. school of fish, herd of antelope, flock of birds.*
- *Visual protection e.g. mimicry, camouflage.*
- *Chemical defenses e.g. secretion of poisonous and repellant substances by scorpions, some grasshoppers; caterpillars.*
- *Alarm signals and calls e.g. by small birds; mammals, various fish and ants.*
- *Development of high sense of sight or smell alerting the presence of predators.*
- *Production of high voltage discharge by cat fish that shock any predator that makes contact with it.*
- *Puffing up and spreading of wings by pea cocks.*
- *Ability to run, fly and swim faster.*
- *Distraction displays e.g. autotomy/self-amputation; e.g. tail of lizard breaks to elude predators or to distract the predators and thereby allowing escape.*

4. (a) Using examples distinguish between **displacement activity** and **vacuum activity**.

Displacement activity	**Vacuum activity**
*Is when an organism in **stress or state of** frustration; e.g. during conflict situation or courtship and mating, perform an action trivial and irrelevant to the situation;* *For example,* *(i). Fighting birds may suddenly press their feathers.* *(ii). Fist clenching in humans* *(iii). Fist banging* *(iv)Nail biting* *(v)Straightening clothes* *(vi)One of the pair birds involved in territorial conflict begin nest building activities e.g. pulling grass.*	*Is when an organism in stress or state of frustration performs a normal response but not directed towards the normal object.* *(i). A girl jumping in air imagining netball* *(ii)A bird snaps at imaginary insects in the air to just exercise instinctive action pattern.* (iii) *A cock deprived of a mate displays to an inanimate object such as a bucket;* *(iv) Bird going through nest building even if there is no nest material available;* NB. ***Vaccum activity provides a means of reducing frustration**.*

(b)What is the importance of **associative learning/conditioning.**

Animals associate experience with reward or punishment; predators learn quickly to associate certain kinds of prey with unpleasant taste or smell; consequently, they are conditioned to avoid them; thus essential for survival of the predators as the prey may be poisonous;

(c) Distinguish between **operant conditioning** and **classical conditioning**

Operant conditioning/ trial and error learning/instructional conditioning	**Classical conditioning/conditioned reflex/Pavlonian condtioning**
Animal learns to associate a particular act with a reinforce	*Animal learns to associate a particular stimulus with reinforcer /unconditioned stimulus*
Animal behavior determines whether or not a reward appears	*Delivery of reward or punishment is controlled by a person*
Removal of cerebral cortex does not cause loss of response	*Removal of cerebral cortex cause loss of response*
Association is less easily removed	*Association is more easily removed*

5. (a)Describe a type of behavior that appears to be a combination of genes and environment.

Instinctive/innate behavior; human babies are born with ability to speak; but the language spoken depends on the environment in which they grow; for example, a Japanese baby grown in Japan will speak Japanese but one raised by a German will learn German language;

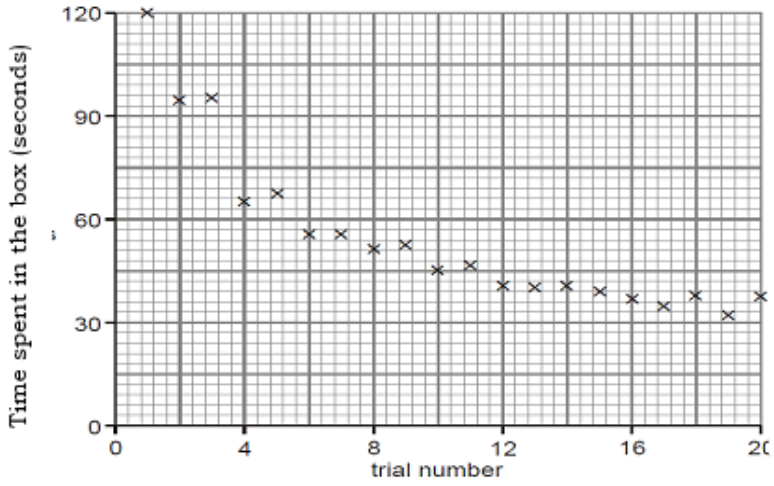
(b) Suggest how **instructional conditioning** could be used in dog training.

Instructional conditioning could be used to reward; or punish specific behaviors of the dog. E.g. a dog could be given a biscuit and each time it offered a paw to its owner/trainer; it would learn to perform this behavior to receive biscuit.

6. (a) Define **operant conditioning**.

Is a form of associative learning; which through trial and error; an animal learns to associate one of its own behaviors with a reward or punishment and then tends to repeat or avoid that behavior. E.g. (i) cockroaches learning to run through a simple maze to find food. (ii) In the skinner's box, a rat learning to press a lever in order to obtain food.

(b). During an experimental trial, a cat was placed inside the puzzle box. If the cat pulled the loop with its mouth or a paw, the door opened and it could escape. The time taken for the cat to escape was recorded. The experiment was then repeated several times with the same cat. The figure below shows a graph of the time taken for the cat to escape from the puzzle box during repeated trials. Study it carefully and use it to the answer the questions that follow.



(i)Account for the changes in the time spent by cat in box at different trial numbers.

Time spent by cat is highest at first trial; because it had not learnt how to escape/environment was new; and still so complex;

Time spent in the box decreased as number of trials increased; because of learning;

Time spent in the box rapidly decreases for the first 6 trials; because greatest change in response occurs; cat is highly motivated; food(reward), appears; thus positive reinforcement; improving performance;

From trials 6 to 20; time spent in the box decreases gradually; because it learnt rapidly to associate escape with the reward; pools loop sooner due to ease to remember; sufficient acclimatization period; repetition enabled learning to occur.

(ii). What evidence shown by the figure shows that learning took place?

Errors reduced with time; Time spent in the box decreases with increase in the number of trials;

(iii). State **three** factors that could affect the learning of a new situation like a puzzle box in animals.

- *Size of rewards or punishments;*
- *State of brain development;*
- *State of development of sense organs;*
- *Complexity of the puzzle box;*

(iv)How could the time needed by the cat to escape out of the puzzle box be reduced?

- *Reducing the complexity of the puzzle box;*
- *Reducing the number of trials per day to enable learning;*
- *On making a wrong choice, it is punished;*
- *Giving food/rat meat at the end of right attempt;*

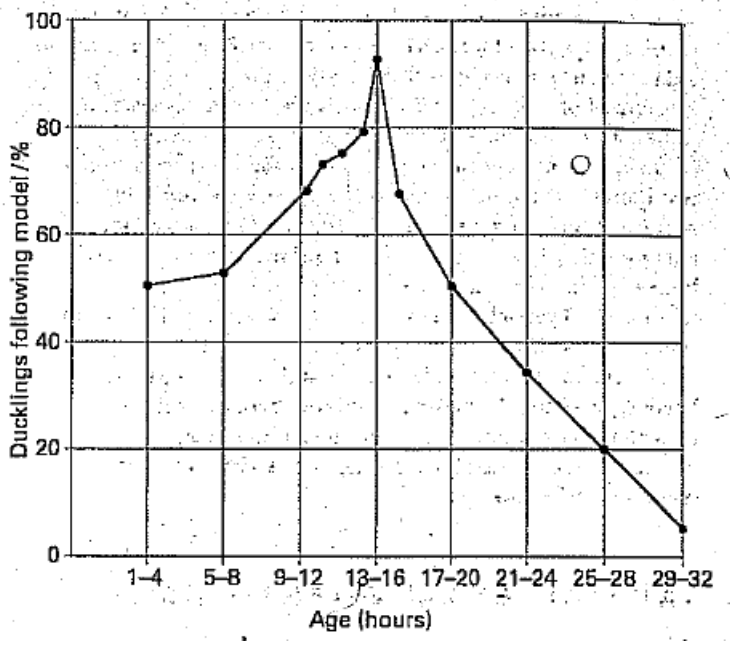
(c)Discuss the characteristics of reflexes.

- ✓ *Instinctive/innate(Unlearned);*
- ✓ *Carried out by all individuals in a species;*
- ✓ *Stereotyped/fixed (Responses to the same stimulus are always similar);*
- ✓ *Inborn; passed on from parent to off springs;*
- ✓ *Automatic, thus do not require learning/conscious thought;*
- ✓ *Conditioned;*
- ✓ *Can be modified, following exposure to new stimulus;*
- ✓ *rapid; and short lived;*
- ✓ *Many are protective;*

(d) Distinguish between a **reflex action** and a **Fixed action pattern.**

In a reflex action, a particular stimulus evokes the same response; while in a fixed action pattern, response to a particular stimulus can be modified by experience; or the precise conditions in which the stimulus is presented;

7.In a series of experiments on ducklings, the effectiveness of imprinting was measured at various times after hatching. In each of these experiments, the ducklings had the opportunity to follow a model duck. The graph in the figure below represents the percentage of ducklings at a particular age which followed the model. Study it carefully and answer the questions that follow.



(a) State the conclusions that can be drawn from the results shown in the graph above

Effectiveness of imprinting/percentage of ducks following model is highest/peaks in ducklings 13-16hours after hatching;

After 16hours from hatching, effectiveness of imprinting/percentage of ducks following model, decreases rapidly;

From 1 -12hours after hatching, effectiveness of imprinting/percentage of ducks following model increases gradually;

(b) Explain the change in the percentage of ducklings that followed the model between 1-12hours after hatching.

From 1 -12hours after hatching, effectiveness of imprinting/percentage of ducks following model increases gradually; because ducklings are particularly receptive to stimuli/model duck; that cause imprinting for only a shorter period after hatching;

(c)What would be the likely consequences on the ducklings hatched if no adult is available to be imprinted on?

Imprint on larger moving objects on first sight; and if it's a predator; ducklings will be preyed upon; due to lack of parental protection; and lack of survival skills passed to them by the adult;

Social dysfunctionality in adult life;

8. (a) What is meant by the term **social behaviour?**

Form of behaviour involving adaptive interactions between two or more animals of the same species;
Highly evidenced in animals that organize themselves into highly structured social groups, societies;

(b) Explain the **advantages** and **disadvantages** to animals of living in societies.

Advantages

- *Better protection against predators; because some watch as others do other tasks;*
- *Increased feeding efficiency; due to group feeding/ sharing of meals;*
- *Better use of and defence of limited resources; due to collective attack of enemies;*
- *Increased survival rates of offsprings ; through communal feeding and protection;*
- *Saving energy by endotherms especially the young by staying close together/ huddling; e.g. penguins;*
- *Faster learning of the young; because the young are close to adults;*
- *Establishment of hierarchies increases chances of survival minimizing aggression;*
- *Enables individual do tasks; they could not do alone; e.g. building beehives;*
- *Greater success in catching larger preys; when hunting in groups than when alone;*
- *Increased reproductive (breeding)efficiency; only the fittest are allowed to breed leading to better quality offspings;*
- *Saving energy by moving animals e.g. fish and birds; by taking advantage of whirling movements in water and air created by other group members;*

Disadvantages

- *Increased intraspecific competition for water, space, food, mates and other resources;*
- *Increased susceptibility to diseases and parasites;*
- *Higher risks of predation on the young by cannibalistic neighbors;*
- *Higher risks of being harvested by humans e.g. the insects;*

(c) The ability to communicate is an essential ingredient of social behaviour.

(i) With a suitable example in each case, give the different modes of animal communication.

Mode(mechanism) of communication	**Example(s)**
(i) *Visual signals/displays*; *Observed in animals during displays of aggression(agonistic behavior) and during courtship preceding reproduction*	(i) *Head up posture by the female stickle back fish initiating courtship;* *(ii) Threat postures e.g. standing erect, baring their teeth and snaring by aggressive wolves and dogs;* *(iii) Red breasts in male Robins elicit threat in other males;* *(iv) Appeasement display e.g. lowering tails and lying on backs by wolves signaling submissiveness;*
(ii) *Tactile/Haptic*; *Involves physical contact/ touch among animals; occurs during social bonding, infant care, grooming and mating;*	*(i) Wolves greet the dominant male in the pack by licking his muzzle;* *(ii) Grooming in primates e.g. chimpanzees;* *(iii) Mother tiger lick and muzzle their babies;* *(iv) Holding, frequently cuddling and comforting the young by female primates;* *(v) A nip(sharp bite or pinch) signaling playing;*
(iii) *Vocal/Acoustic/auditory* *Involves sounds; Used over long distances, through water and at night;*	(i) *Songs of male birds provide for species recognition; a display to attract mates; and warning to other males of territorial boundaries;* *(ii) Calls of male frogs and male crickets ward off male rivals, attract females; and function in species recognition;* *(iii) Use of infrasound(below the audible range of humans) by herd of related female elephants for greeting; and communicating danger;*
(iv) *Chemical (Olfactory and taste);* *Chemicals elicit responses when they are either smelled or tasted;* NB Chemical substances secreted by one organism and stimulates a physiological or behavioral response in another organism of the same species are called **pheromones;**	*(i)Secretion of a chemical substance from the surface of body of unmated female cockroaches to stimulate males into courtship;* *(ii) secretion of a pheromone by dead ant stimulating other ants to throw it out of the nest;* *(iii) Worker ants secrete a (releaser) pheromone to mark trails that guide other workers to food;* *(iv) Reproductively receptive female moths attract male moths by secreting (releaser) pheromone in the air;* *(v) Queen bees secrete (primer) pheromone/ 'queen substance', oxodecanoic acid from its mandibular glands smearing it over its body which when licked by workers; prevents building of queen cells to rear new queen;* *(vi)Spraying urine by many male mammals around borders of territory to warn other animals of the same species to keep off;*

(ii) Outline **three** benefits and **two** disadvantages of pheromone communication.

Benefits

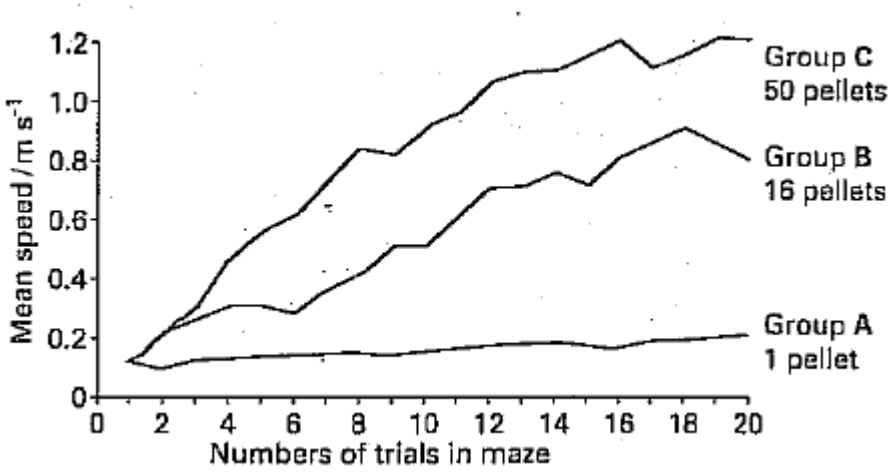
- *Little energy is expended in synthesis of pheromones;*
- *Pheromones last for several hours/longer;*
- *Allows communication in the dark;*

Disadvantages

- *Limited information content;*
- *Slow transmission;*

9. In an investigation on the ability of rats to learn the route of a maze, three groups of rats were treated as follows.

Group **A**: Placed in a maze, given one pellet of food when it finds its way out.
Group **B**: Placed in a maze, given 16 pellets of food when it finds its way out.
Group **C**: Placed in a maze, given 50 pellets of food when it finds its way out.
Each rat in the three groups was put through the maze 20times, and the time taken for each rat to get through the maze was measured and the mean speed for each group calculated.
The results are shown in the figure below. Study it carefully and answer the questions that follow.



(a) Describe one piece of evidence that the rats were able to learn their way through the maze.
The more times the rats navigated the maze, the faster they got at finding their way out;
(b) Explain the difference in the mean speed of group **C** and group **A** rats.
Mean speed of group C rats is higher than that of group A rats /group C rats were faster in getting their way out of the maze than group A rats throughout the 20 trials; because larger amounts of food pellets/reward in group C rats increased /reinforced their association of reward with movement through the maze than in group A rats/provided more motivation than in group A rats;
(c) Suggest and explain the type learning behaviour demonstrated in the experiment above.
Operant conditioning/ trial and error learning/instructional conditioning/instrumental conditioning; trial motor activities gave responses which were reinforced by a reward; association of the outcome of response in terms of reward increased future responses; Associative learning efficiency increased with repetition/trials;
(d) Why is periodic reinforcement more preferable to continuous reinforcement during conditioning?
More effective than continuous reinforcement; as with continuous reinforcement, habituation occurs; subsequently diminishing an operant response/extinction occurs;
10.(a) In the study of behaviour, outline **three** types of stimuli.

- *Motivational stimuli;*
- *Releasing stimuli/ Releasers;*
- *Terminating stimuli;*

(b) State **two** examples of each of the stimuli in (a) above.

Stimuli	**Examples**
Motivational Are those determining an animal's state of responsiveness, by providing a drive for a behavioral response)	*(i) Depleted food stores in the body during hibernation results in awakening and food seeking;* *(ii) Smell of food makes an animal more conscious of being hungry;*
Releasers(Are those which elicit particular behavioral responses when the animal encounters them)	*(i) Herring gull chicks pecking at the red spot of the parent's bill to release food(fish) into their beak;* *(ii) Red breast in male Robin elicit threat in other males;* *(iii) Female stickleback's swollen abdomen elicit a male's zig-zag courtship dance;* *(iv) Red belly in male stickleback elicit threat in other males;*
Terminating (Are those that bring the act of behaviour to an end)	*(i)Satiety accompanying ejaculation in the males terminates copulation;* *(ii)Increased abdominal blood pressure in Rhodnius to a certain critical level stops the action of muscular abdominal pump, and sucking ceases;*

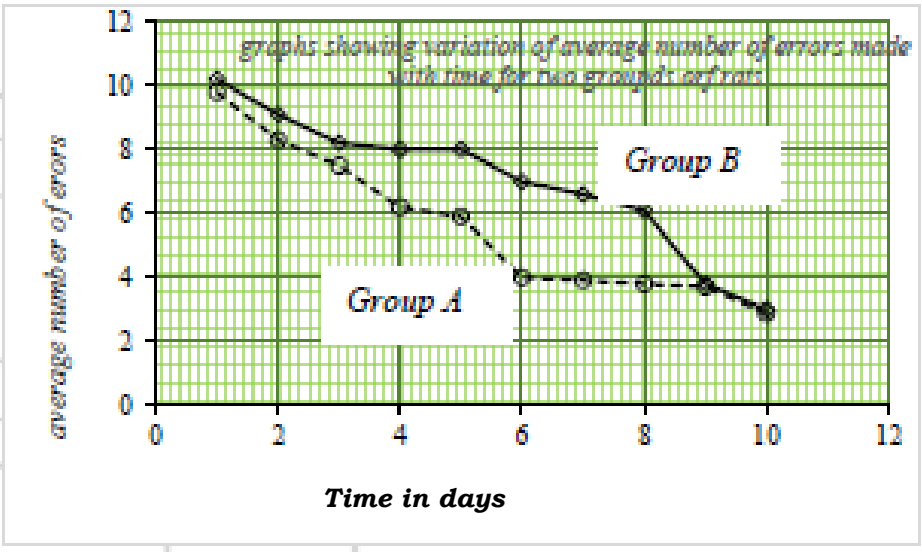
(c) State **three** biological significances of pheromones in organisms.

- *Control of pests e.g. gypsy moths by luring males to traps baited with synthetic analogs of the female pheromone;*
- *Sex attractant in many species of insects, birds, fish and mammals;*
- *Sex recognition*;
- *Marking out territories*;

11. Two groups of rats were run through a maze every day for 10days. Group **A** always received food on reaching the end of the maze. Group **B** only received food for the last three days and not for the first seven days.
The average number of errors made by the rats in each group while finding their way through the maze is shown in the table below.
Study it carefully and answer the questions that follow.

Time (days)	Average number of errors made by rats	
	Group **A**	Group **B**
1	9.8	10.2
2	8.3	9.1
3	7.5	8.2
4	6.2	8.0
5	5.9	8.0
6	4.0	7.0
7	3.9	6.6
8	3.8	6.1
9	3.7	3.8
10	2.9	3.0

(a) Represent the information in the tale on a suitable graph



(b) State the type of behaviour is being investigated in the above experiment.
Learned behaviour;
(c) Explain the difference in the results obtained on day five in the two groups of rats.
Average number of errors made by group A rats is lower than by group B rats; because provision of food/reward to group A rats on reaching at end of maze, increased /reinforced their association of reward with movement through the maze than in group B rats/provided more motivation than in group B rats

(d) Explain the period of greatest change in the results.
Between day 6 and day 9; average number of errors made by group A rats were decreasing gradually/remained almost constant; because without change in nature/amount of reward; habituation occurs; subsequently diminishing an operant response/extinction occurs;
In the last three days of the experiment/Between day 8 and day 10; group B rats made less errors owing to their behaviour being reinforced with a reward; subsequently improving their performance;
(e) Describe the role of the hypothalamus in controlling behaviour.
Controls pituitary gland secretions; which in turn control the endocrine system;
Hormones secreted under the control of hypothalamus influence behaviour by,

- *Affecting growth of nervous connection in the brain;*
- *Altering sensitivity of peripheral receptors e.g. male hormones in rats raises sensitivity of the penis; subsequently enhancing sexual behaviour;*
- *Affecting performance of effects; either by enhancing or suppressing them;*
- *Affecting nerve cells and synapses within the central nervous system; resulting into inhibitory or excitatory postsynaptic potential*;

12 (a) What is meant by **motivation.**

Internal state of an organism which must precede a specific act of behaviour; OR
State within an organism that drive behaviour towards some goal;
Thus modify the nature and extent of any behaviour.

Example. A hungry organism on given food, feelings of hunger diminishes*;*

(b) Give the significance of motivation in animals.

- *Balances the organism's immediate needs with the ultimate purpose of ensuring survival;*
- *Ensures that mating coincides with the optimum time for fertilization; thus ensuring production of offsprings at the most favorable time of the year for their survival;*
- *Preserves the species gene pool; e.g. most birds forego feeding to ensure successful hatching of young ensuring continuity of life;*

(c) Distinguish between the following terms, giving an example in each case.

(i) **Circadian rhythm** and **circannual rhythm**

Circadian rhythms	**circannual rhythms**
Patterns of behaviour that recur in an approximately 24-hour interval; e.g. (i) Small desert mammals *hiding in burrows during the heat of the day*; and *gathering food at night when environmental temperatures are lower*; (ii) *Mammalian predators eat during day; and resting in the night;* *(iii) Feeding behaviour in polychaete worm living in burrows on muddy shores.* (**Kent page 238**) (iv) *Fruit fly emerge from the pupa at dawn*; (v) *Changes in body temperatures; i.e. lowest in early hours of morning, and peaking in late afternoon.*	*Pattern of behaviour that recur in an approximately one-year interval*; e.g. (i) *Breeding;* *(ii) Bird migration;* *(iii) Hibernation*;

(ii) **Endogenous cues** and **Exogenous cues**

Endogenous cues are internal mechanisms that drive the behavioral cycles in organisms; e.g. hormonal changes; while exogenous cycles are external/environmental factors driving behavioral cycles in organisms; e.g. water availability, light intensity and temperature;

(d) Of what significances are biorhythms?

- *Synchronises feeding in predators to time when prey is more vulnerable to capture;*
- *Ensures proper timing of courtship and mating to season of highest food availability to the nursing parent and the growing young ones;*
- *Enables migratory organisms to timely avoid unfavourable seasonal conditions; and meet favourable ones on migration;*
- *Synchronises feeding activity with time of adequate food availability*;

13. (a) Distinguish between **dispersion** and **migration** as used in animal movement.

Dispersion	**Migration**
Spreading of individuals away from others; e.g. movement of mammals away from their social group.	*Long distance seasonal movement; e.g. locust swarms, bird migration;*
Occurs in different directions	*Occurs in definite directions*
Not confined to a definite season/Irregular	*Confined to a definite season/Regular*
Limited to certain members of the population	*Involves entire population*

(b) Outline **five** ways how birds find their way on immense journeys.

- *Use of distinctive smells;*
- *Wind direction;*
- *Topography;*
- *Position of the sun by daytime-migrants;*
- *Position of the moon and star by night-migrants;*
- *Use of earth's magnetic field by most birds*;
- *Young birds e.g. geese follow ways shown by older ones;*
- *Cloud patterns e.g.* Whooper swans *land on the seas in darkness when there is heavy cloud and no moon;*

(c) What are the causes of migration in different animals?

- *Seasonal availability of food in different habitats;*
- *Degradation of environmental conditions such as temperature; Many bird species migrate to warmer areas during winter in escape of extreme cold conditions*;

- *Breeding purposes; e.g. Reproductively mature salmon migrate back to fresh water streams to breed;*

(d) State the **main** advantages of seasonal migrations.

- *Ensures adequate food supply at all times;*
- *Enables migrants avoid seasonal bad weather;*

} Main advantages

- *Reduced risks of predation;*
- *Allows maximum utilization of food/prey in parts where organisms may not be able to live permanently;*
- *Avails opportunity for different members of the population to meet; and subsequently greater breeding variety;*

14. (a) What is meant by the following;

Form of behaviour	**Meaning**	**Example(s)**
(i) Insight.	*Highest form of learning; involving immediate comprehension and response to a new situation; without trial-and-error;* Involves mental reasoning or intelligence to solve detour problems;	*-Stacking boxes on top of each other by chimpanzees to allow it access bananas previously beyond reach;* *-A child using stones to hit at mango fruits high on the tree;*
(ii) Latent/Exploratory learning.	*Form of behaviour in which an animal explores its environment; stores information about it to be used later in life;*	*-A rat recognizing a hole/burrow in its habitat to be used when in trouble to escape;*
(iii)Altruism/Altruistic behaviour.	*Form of social behavior where an organism(donor) puts itself at risk or personal disadvantage for the benefit of others of the same species(recipients)*	*-Alarm calls by ground squirrels warning others of the approach of predators;* *-Female baboons protects and cares for its offsprings for almost 6years;* *-Female monkeys caring for the young ones of others;*
(iv)Aggression/agonistic behaviour.	*Group of behavioral activities including rituals, threat postures, and occasionally physical attacks on other organisms other those associated with predation usually to members of same sex and species;* -Its highly ritualized(symbolic, with no harm) and rarely results into injury;	*- Threat postures e.g. standing erect, baring their teeth and snaring by aggressive wolves and dogs; weaker rival cowers, exposing sides of its neck,* *- Red belly in male stickleback elicit threat in other males* *-Raising feathers by birds* *-Raising fur in cats;*
(v)Dominance/social hierarchies.	*Form of animal social structure in which a linear or nearly linear ranking exists; which each animal dominant over those below it; but submissive to those above it in the rank;*	*-Peck order in chicken*

(b) Explain the adaptive significances of following patterns of behaviour.

(i) **Courtship and mating behavior**

- *Stimulates organisms to sexual activity;*
- *Synchronizes gonad development; enabling gametes mature at the same time; to ensure fertilization occurs; when mating takes place.*
- *Suppresses negative tendencies like avoidance of body contact; escape behavior and cannibalism.*
- *Tightens pair bond between mating pair*
- *Leads to rise in the levels of reproductive hormones and maturation of the gonads.*
- *Induces mating of the individuals of the same species who accept each other.*
- *Synchronizes time to produce off springs with availability of food.*
- *Provides protection to courting individuals.*
- *Highly species specific; ensuring that breeding only takes place between members of the same species.*
- *In some species, it reduces the natural aggressiveness of the female enabling the male to approach and mate with her.*

(ii) **Dominance hierarchies**

- *Gives opportunity to the strongest/dominant individuals pass on their genes;*
- *Ensures that resources are distributed with minimum fuss;*
- *Reduces on unnecessary expenditure of energy for continually competing with group members for resources;*
- *Decreases the amount of individual aggression associated with feeding, mate selection and breeding site selection*

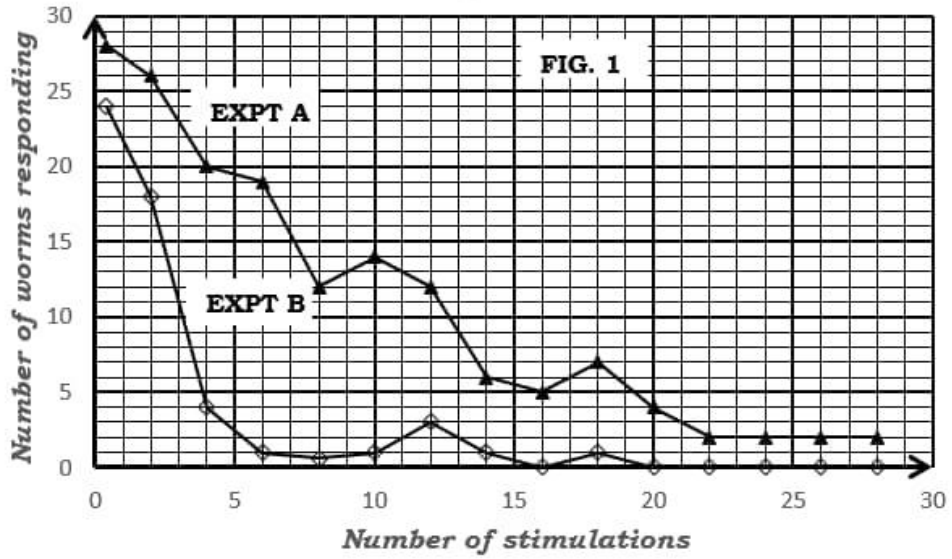
(iii) **Agonistic behaviour**

- *Eliminates unfit individuals from the population;*
- *Basis of selection of mates for courtship and mating;*
- *Establishment of higher rank in a pecking order;*
- *Keeping off predators and competitors;*
- *Resolves conspecific conflicts*
- *Protection of territories by members of a species;*

(iv) **Altruism**

- *Ensures protection; and survival of the weak and the young ones;*
- *Increases allele frequency of a particular organism;*
- *Ensures continuity of species of organisms;*
- *Ensures continuous food supply for the young ones; and other members of the group;*
- *Leads to increased population size;*

15. In an investigation of habituation to touch by a group of Peacock worms, ***Sabella pavonia,*** groups of worms were tested by brushing their protruding crown of tentacles.
    Two separate experiments were carried out.
    Experiment **A**: Worms were stimulated so gently that they jerked slowly in their tubes.
    Experiment **B:** Stimuli were sufficiently strong to evoke a rapid response from the worms.
    Results of the experiment are as shown in graph in the figure **1** below.



(a) Describe the effect of frequency of stimulation on the responses of the group of worms in experiments **A** and **B**

At 0.4 stimulation, highest number of worms responding is attained in both experiments A and B;
Increase in number of stimulation from 22 to 28, has no effect on the number of worms responding in experiment B; with number of worms responding remaining constant in experiment A;
Increase in number of stimulations from 8 to 20, causes number of worms responding to fluctuate in both experiments A and B;
Increase in number of stimulations from 20 to 22; gradually decreases number of worms responding in experiment A;
Increase in number of stimulations from 0.4 to 8; decreases number of worms responding in both experiments A and B;

(b) Explain the;

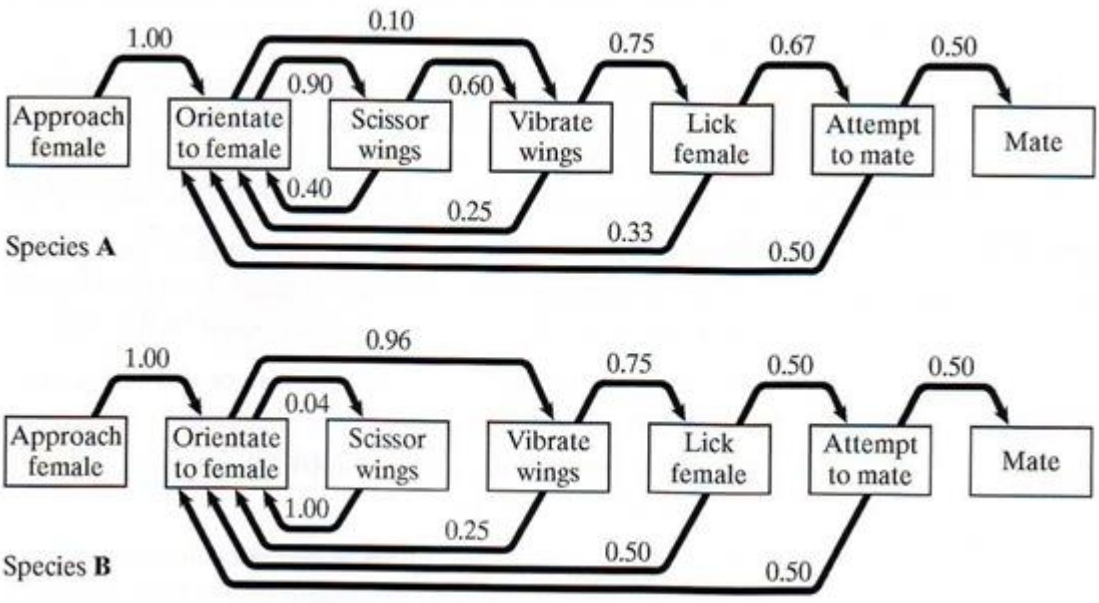
(i) difference in the effects of intensity of stimulation on the number of worms responding in both experiments **A** and **B**.

Gentle/weak stimulation causes a higher number of worms responding; because low frequency impulses are generated; in the receptors and synapses; few receptors in few worms adapt/fatique; allowing more worms to continue responding;
Strong stimulation lowers the number of worms responding; because high frequency impulses are generated; in the touch receptors and synapses; many receptors easily adapt/fatique in many worms; impulse transmission is inhibited; subsequently lowering number of worms responding;

(ii) responses of group of worms in both experiments **A** and **B** beyond 22 number of stimulation.
*From 22 to 28 number of stimulation, number of worms responding is low; and remained constant in both experiments A and B; because higher number of stimulation generate **high frequency impulses**; few sodium ions diffuse into touch receptor cell; and also **inhibit release of neurotransmitter substance at the synapse**; threshold is not reached; no action potential generated; subsequently no further response by the worms;*
(c) Of what significance is the behaviour of touch receptors of worms in both experiments **A** and **B** beyond 22 number of stimulation to living organisms?
*Beyond 22 number of stimulation, touch receptors are **adapted**; thus*

- *Allows organisms ignore unchanging background information; concentrating on monitoring aspects of the environment which have more survival value;*
- *Prevents overloading of the central nervous system with irrelevant and unmanageable information; increasing the efficiency of nervous system;*
- *Provides organisms with precise information about changes in its environment*;

Activity
16. (a) Courtship and mating in fruit flies can occur equally well in the light or dark. Explain why fruit flies which mate in the dark are much more likely to produce offsprings than those which mate in the light.
(b) The figure below shows the courtship sequence of males from two closely related species of fruitfly (species **A** and species **B**). The numbers show the probability of one courtship element following from another.



(i) Once a male of species **A** has orientated to the female, what is the probability that he will perform each courtship element once only and then attempt to mate?
(ii) Suggest how the courtship sequences provide evidence to support the claim that the two species are;

- Closely related
- Separate species

(iii) During courtship, vibration of the wings creates a sound.
The sound is different in the two species of fruitfly. Explain how this prevents mating between members of different species.
17.(a) The theory of classical conditioning is based on Pavlov's work on the control of salivation in dogs. In Pavlov's experiment, what was the;
(i) unconditioned stimulus?
(ii) conditioned stimulu?
(iii) response to the conditioned stimulus?
(b) The main part of the dog's diet is normally meat. Suggest why increased salivation would not be expected to help in the digestion of this component of the diet.