

Q. No. 2 Part (i) **Rib Cage**:- The rib cage is made up of 12 pairs of ribs. The first 7 pairs are directly attached to the sternum hence are called **True ribs**. The 8th, 9th & 10th pair is attached to the sternum by costal cartilage hence are called **False ribs**. The 11th & 12th pair is ~~attached~~ not attached to the sternum hence are called **Floating ribs**. The Rib cage articulates posteriorly to the thoracic vertebrae.

**ADVANTAGES**:- The Rib cage protects the ~~vestigial org.~~ visceral organs. The advantage of some ribs being attached to the sternum ~~to~~ indirectly is this that it provides flexibility to the cage and can withstand excessive pressure on the chest.

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Q. No. 2 Part (ii) **Embryonic development:-**

The developmental process through which an embryo goes to acquire an adult form is called embryonic development. There are 4 major phases involved among them the 3 are:-

(1) Cleavage:- The repeated mitotic divisions through which the zygote undergoes to form the blastula is called cleavage. There are two types.

(2) Gastrulation:- The process of differentiation of embryonic germ layers to convert the blastula to gastrula is called gastrulation.

(3) Organogenesis:- The stage of organ & organ system development is called organogenesis. Neurulation is the major event.

Q. No. 2 Part (iii) **Chromosomes**:- Thick condensed highly coiled thread-like structures that appear during cell division are called chromosomes. They have a thickness of 700 nm.

**Genes**:- The particular sequence of nucleotides along the length of DNA (or short segment of DNA) is called that specifies the information of the synthesis of a particular protein are called genes.

**Chromosomes & genes**:- Since chromosomes are made up of 40% DNA, so they consist of nucleotide base sequences and the genes are all present on along the length of chromosomes specifying specific sequences of nucleotides. <sup>thus chromosomes</sup> carry genes.

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Q. No. 2 Part (iv) **Convergent** **Divergent**

**evolution** :- The type of evolution in which different organisms evolve from a ~~different~~ **common** ancestor in a common habitat.

> It involves the inheritance of ~~homologous~~ **analogous** structures

> The structures are different in structure but similar in function

**Eg** :- Wings of Bird & Bat are different but both <sup>are</sup> used in flying.

**evolution** :- The type of evolution in which different organisms evolve from a common ancestor in different habitat

> It involves the inheritance of **homologous** structures

> The structures are similar but different in function

**Eg** :- Wing of Bird & hand of Human <sup>have pentadactyle</sup> configuration but func:

Q. No. 2 Part (v) **Superiority of Nasal Breathing:-**

Nasal breathing is considered more superior to mouth breathing because the nasal cavity is equipped with vestibular hair, mucous & cilia which function to filter the incoming air from pathogens and particulate matter and moisten & warm the air whereas the mouth (oral cavity) lacks these structures and thus there are greater chances of the person being infected by pathogens.

**Muscle Contractions:-**

Inhalation	Exhalation
(1) Diaphragm:- Contracts (looses dome shape)	(1) Diaphragm:- Relaxes (Dome shaped)
(2) External intercostal:- contract	(2) Internal intercostal:- Contract
(3) Internal intercostal:- Relax	(3) External intercostal:- Relax.

Q. No. 2 Part (vi) **Natural selection**: This term refers

to the differential reproductive capacities of organisms in a population, where some reproduce efficiently while others don't. Darwin's theory of natural selection was based on two points one of these was natural selection in which over production, variation, struggle for existence and survival of the fittest is described. According to Darwin, only those organisms would survive to maturity who would have favourable alleles in the gene pool, all the others would be eliminated. **(2) Descent with modification**

Darwin perceived unity with all organisms descending from a common ancestor. He thought life as a tree with multiple subbranching. An ancestor is present at each fork.

Q. No. 2 Part (vii) **Integrated disease management**

Control of a particular disease or all common diseases from the population by using relevant and appropriate preventive measures is called integrated disease management.

In light of integrated disease management, the measures needed to be taken are that awareness of the severity of the disease should be spread, the community should be involved, awareness should be spread by electronic and disseminate media, by holding seminars in colleges & universities and also by vaccinating the people against the particular disease by inactivated pathogens.

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Q. No. 2 Part (viii) **Sympathetic** **Parasympathetic**  
**system** :- The division of the autonomic nervous system that controls the autonomic systems during emergency state.

> Involves only spinal nerves arising from 1st thoracic to 2nd lumbar.

> Flight or Fight response.

> Eg - Dilates pupil, tachycardia

→ **Contrast** :- Both are involuntary automatic systems that work subconsciously, as a part of PNS.

**stem** :- The division of autonomic nervous system which controls the autonomic systems during state of rest.

> Consists of cranial nerves specially vagus nerve and spinal nerves from sacral portion.

> Rest or Digest response

> Eg - constricts pupil, normal BP.



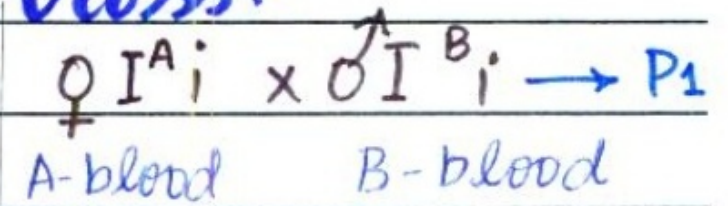
Q. No. 2 Part (ix) **Local anaesthesia**:- When local anaesthesia is given it blocks the perception of pain by binding to the receptor sites in the post synaptic membrane. This effects the nerve impulse transmission of pain.

**Reason**:- Since the receptor sites are blocked, so when the nerves impulse is to be transferred across the synaptic cleft, the neurotransmitter released by the presynaptic membrane cannot bind to the post synaptic membrane, as a result, the sodium ion permeability of the postsynaptic membrane cannot be increased, thus, the membrane potential cannot be brought to threshold level and so no nerve impulse is generated in it.

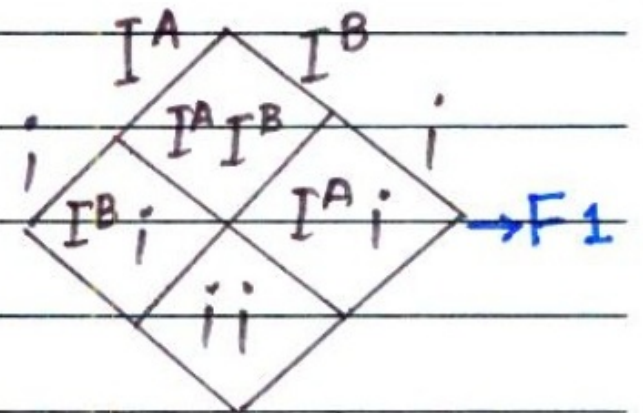
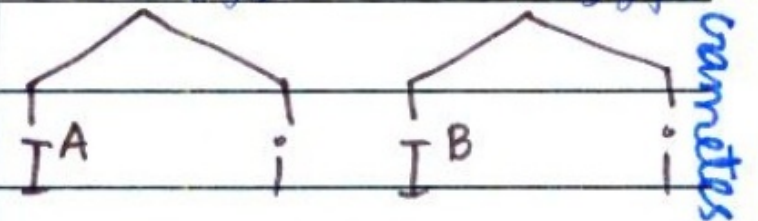
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Q. No. 2 Part (x) The child can only have a blood group 'O' despite his parents being 'A' & 'B' is when the parents are **Heterozygous** for their blood group i.e. they have  $I^A i$  &  $I^B i$  genotype respectively because, O-group being recessive, both the parents must contribute at least one recessive allele "i".

**Cross:-**



Heterozygous Heterozygous



Ratio =  $1:1:1:1$   
 ~~$1:2:1$~~   
**AB : A : B : O**

Q. No. 2 Part (xi) **DNA analysis**:- The technique employed by Forensic scientists to identify individuals on the basis of their nucleotide sequence of DNA.

**Applications**:- (1) To find out the victims of a crime scene or catastrophe.

(2) Determine paternity relations or other family relations.

(3) To find out the Bacteria or other microorganisms that are polluting the water, soil and air.

(4) To determine the potential suspects of a crime scene.

Q. No. 2 Part (xii) Major steps of DNA sequencing

The major steps involved in DNA sequencing are:-

- (1) To form small fragments of DNA all starting from the same point.
- (2) To differentiate the differently sized DNA fragments on the basis of their mass, length, structure and charge.
- (3) To view the separated DNA fragments on the gel using ultraviolet transilluminator or autoradiography.

Q. No. 2 Part (xiii) **Epistasis**: The phenomenon in which a gene at one locus masks the effects of the gene present at another locus with its own effect. Epistasis is a non-allelic interaction. It is different from dominance in the following way.

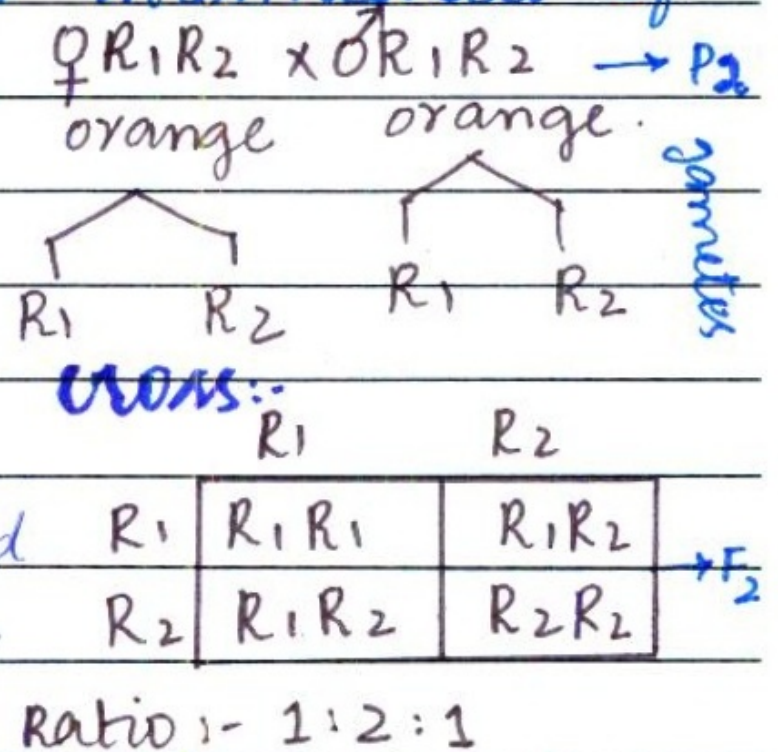
### **Dominance**

- > Involves one gene
- > One allele masks the other
- > The recessive allele is suppressed.
- > The dominant allele is expressed.

### **Epistasis**

- > Involves 2 genes.
- > One gene masks the other.
- > The dominant and recessive alleles of the hypostatic gene are suppressed.
- > Both the alleles (Dominant & recessive) of epistatic genes express.

Q. No. 2 Part (xiv) The inheritance pattern observed is called Incomplete dominance. **Incomplete dominance**:- The type of dominance relationship observed when both the alleles expressed themselves in a blended form i.e. the phenotype of the heterozygous individual is an intermediate of both its parents. Because orange is an intermediate of red & yellow so this is incomplete dominance in which both alleles express in a blended form. If these organisms interbreed then a 1:2:1 ratio is observed for yellow, orange & red respectively.



Q. No. 3 (Page 1) **Identification:**

**E** → LH (Luteinizing hormone).

**F** → FSH (Follicle stimulating hormone).

**G** → Estrogen

**H** → Progesterone.

# Menstrual CYCLE

**Definition:** "The cyclic events which the female reproductive cycle undergoes is called the menstrual cycle."

The menstrual cycle is divided into two cycles the uterine & ovarian cycle, both of which are regulated according to hormones of pituitary and hypothalamic hormones. Menstrual cycle has three major events.

## (1) Mentruation Phase (Day 1-5):-

This phase is characterized by the shedding of the spongy thick endometrial lining of the uterus. The uterus sheds all but the deepest layers of its endometrium and this is accompanied with bleeding for

3-5 days. This endometrial tissue and the blood are called collectively the menstrual flow and it passes through the vagina to the out side of the body.

Q. No. 3 (Page 2) Initially, the hormonal levels were low but towards the end FSH levels increase.

(2) **Proliferative phase:- (Day 6-14):** <sup>Pro-</sup>stimulatory

The rising levels of FSH, induce the ovarian follicles to start ripening, as a result many start to ripen but they struggle to gain dominance. Eventually, all except one disintegrate (follicular atresia). The dominant follicle matures to form a **graafian follicle** where oogenesis occurs.

The FSH stimulates the graafian follicle to release **estrogen**. Estrogen has two effects:-

(1) **Cervical mucous:-** Normally, the cervical mucous is thick and sticky but the estrogen acts on it and causes it to **thin out & crystallize**, thus forming channels for the entrance of the sperm.

(2) **Endometrium:-** It causes revascularization of the endometrium lining making it **thick and velvety**.

**Effect of estrogen of FSH:-** estrogen has a negative effect on the FSH so FSH levels drop, stimulating the release of LH.

The LH hormone is usually released on the 14th day and has 2 effects:-

(1) **Ovulation:-** LH stimulates the graafian follicle to release its oocyte into the oviduct. This process is called **ovulation** and it takes 5 minutes. The ruptured follicle forms a yellowish glandular body i.e **corpus luteum**.



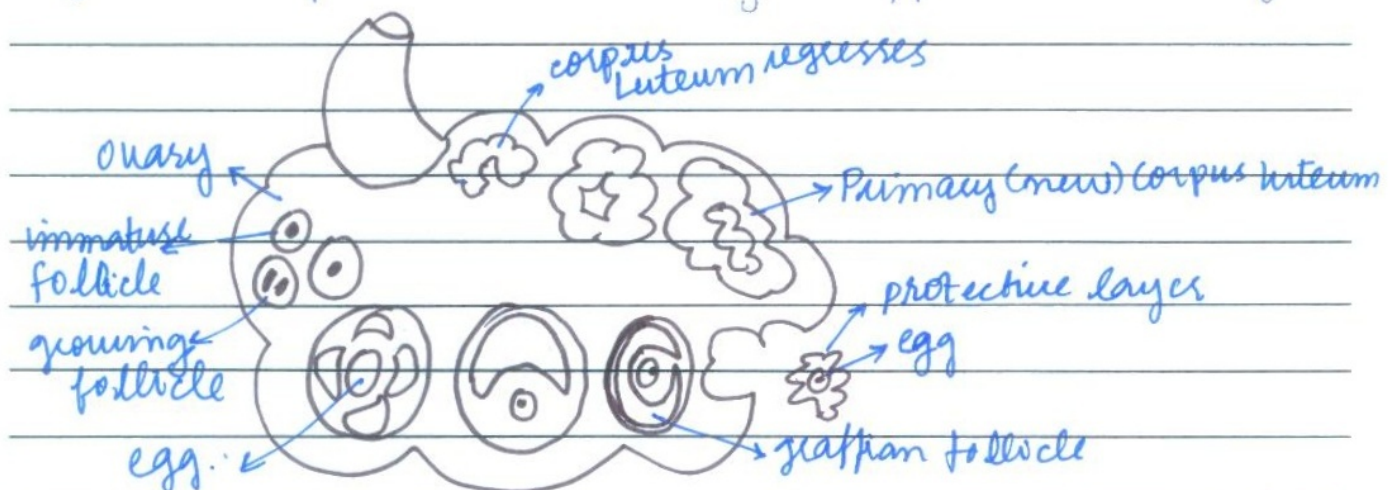
Q. No. 3 (Page 3) (2) Progesterone:- LH stimulates the corpus luteum to release progesterone.

### (3) Secretory phase (Post ovulatory)

Day 15-28 :-

→ Fertilization:- This phase is characterized by the preparing of endometrium for pregnancy. The progesterone causes the blood vessels to elaborate causing vascularization of the endometrium. Thus, it turns from a function layer to glandular layer. Moreover, the endometrial glands enlarge, coil & begin secreting glycogen into the womb which acts as a source of nutrition for the developing young, until it embeds into the endometrium.

→ No fertilization. The corpus luteum regresses leading to decrease in progesterone and dying of the hormone-dependent endometrial cells. leading to bleeding at 28th day. Moreover, there is **Menopause** in which the menstrual cycle stops, it usually happens at 50 years.



## (1) HABBITUATION:-

**Definition:-** The ignored response of an individual to a irrelevant and continuous stimuli is called habituation.

**Explanation:-** When there is a repeated stimulus about something which is of no use the the organism doesn't respond to it after some time i.e the organism's diminished response to a stimulus is habituation. For example, squirrel living in a community listen to the stimuli released by an endemerged squirrel and hides in the nearest refuge comp.

However, if this stimulus is from a squirrel which has often sent repeated false signals, then his all of his signals would be completely ignored.

**Examples from Human perspective:-**

When we wear clothes, we feel that + sensation of clothes touching our body, but after some time, this stimulation is ignored as we become habitual of the clothes rubbing against our skin.

## (2) CLASSICAL CONDITIONING

**Definition:-** The same response to an individual to two very different stimuli which are given to it simultaneously is called classical conditioning.

Q. No. 4 (Page 2) **Explanation**:- Pavlov performed this experiment by pairing meat powder with another stimuli such as a ringing bell. First these were given simultaneously but then soon once only the bell was used and the dogs responded by salivating. Thus, first, the ringing bell was a neutral stimulus but the dogs associated it with food and now it is called the conditioned stimulus and the response is called conditioned response.

**Examples from Human Behaviour**:- classical conditioning can be described as when we salivate just upon hearing the names of certain foods like tamarind, lemons, or something spicy. Thus these names are conditioned stimuli & the salivation is the response.

### (3) LATENT LEARNING

**Definition**:- The behaviour of an organism in which he learns a response to a stimulus through daily life not through rewards & punishment such that when he is again exposed to the same stimulus, he responds to it from his past experience.

**Explanation**:- K.L. Latley performed an experiment in which he took a mouse and placed it in a puzzle. The mouse found its way to the exit but also found the

Q. No. 4 (Page 3) location of food. the next time he was placed and he was able to quickly find the food as he was hungry from his past experience.

**Human behaviour:-** We can easily get to a place in less time if we know the location and have been through the route previously then as compared to if we hadn't then we would've taken longer.

**(4) Insight learning:-** The ability of an individual to respond to his ~~an~~ stimuli using the higher centres of his brain. He usually calculates in his brain that which adaptations can help him to succeed rather than fail in the first try.

**Experiment:-** Wolfgang Kohler enclosed chimpanzees in a cage with bones and high up bananas. The monkeys responded by stacking the bones & climbing them to reach the bananas. No past experience had provided them this response.

**Human behaviour:-** Our ability to respond to mathematical problems is insight learning as it involves us using our brain.

# Anterior Lobe of Pituitary gland

The anterior lobe of Pituitary gland is called the master gland because it produces a number of hormones that directly control the functions of the other glands. Some hormones released by it are in numbers.

**Growth hormone**:- Its release is stimulated by the release of hypothalamic growth hormone releasing factor & is inhibited by somatostatin. It has a direct effect on the growth as it increases the uptake of amino acids and increases protein synthesis.

**Under secretion**:- Undersecretion leads to dwarfism in which the individual has a short stature but a proportionate body size & the brain development is not effected.

**Oversecretion**:- If it is oversecreted during growing age then it leads to gigantism in which the bones grow in length and so the individual has an abnormal body height.

Q. No. 5 (Page 2) If oversecretion is after growing age when the bones have lost the ability to grow in length, the growth hormone acts on them and causes them to increase in width thus leading to enlarged hands, feet and jaw. This is known as acromegaly.

**(2) Thyroid stimulating hormone:-** → Stimulation

The thyrotrophin releasing factor of the hypothalamus stimulates the release of the thyroid stimulating hormone.

→ **Function:-** It increases the cells of the thyroid gland and controls the production and release of the thyroid hormones.

→ **Oversecretion:-** Oversecretion leads to **Hyperthyroidism** which is characterized by increased metabolic rate due to increased release of thyroid hormones.

→ **Undersecretion:-** Undersecretion leads to **Hypothyroidism** which is characterized by decreased metabolic rate i.e. Myxedema due to decreased release of thyroxine.

**(3) Adrenocorticotrophic hormones:-** → Stimulation

The hypothalamus upon low blood steroid levels releases ~~ad~~ corticotrophin releasing factor which stimulates the anterior lobe to release adrenocorticotrophic hormones.

It can also be released by direct stimulation of nerve impulses when the body is under

Q. No. 5 (Page 3) stress conditions i.e cold, etc.

→ Function :- Acts of adrenal cortex to release corticosteroids.

→ Oversecretion :- Oversecretion leads to muscle weakening <sup>(bone)</sup> → Undersecretion :- Addison's disease where metabolic disorder takes place by muscle weakening & loss of salts.

**(4) Gonadotrophic hormone** :- The follicle stimulating hormone (FSH), the luteinizing hormone (Interstitial cell stimulating hormone) and Prolactin (Luteotrophic hormones) are collectively called gonadotrophic hormones and they are released upon the stimulation from hypothalamus, where it releases gonadotrophin releasing hormone. They act on gonads.

Thus, the hormones released by anterior lobe of Pituitary gland are :-

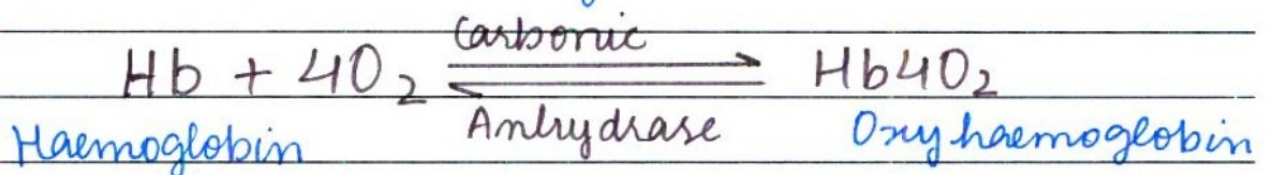
- (1) Growth hormone
- (2) Thyroid stimulating hormone
- (3) Adrenocorticotrophic hormone
- (4) Prolactin
- (5) FSH
- (6) LH

## → TRANSPORT OF OXYGEN :-

The transport of oxygen takes place through two ways i.e.

- (1) Through the plasma (dissolved) → 3%
- (2) As oxyhaemoglobin (99%)

**Oxyhaemoglobin**:- Oxygen is most efficiently transported in the blood as oxyhaemoglobin in which the haemoglobin combines with 4 oxygen molecules to form oxyhaemoglobin in the presence of carbonic anhydrase enzyme. This reaction is reversible. The haemoglobin only combines to the oxygen under high partial pressure of oxygen. However, if  $PO_2$  in the tissue is lower it readily dissociates, releasing the oxygen into the tissue. This occurs at a partial pressure of 60 mmHg.



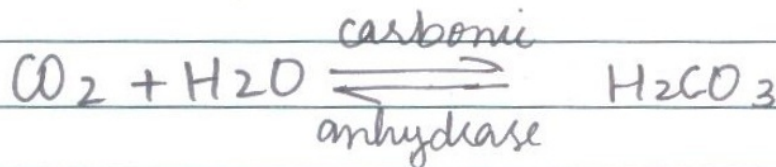
## → Transport of Carbon dioxide:-

- (1) As bicarbonates:- Carbon dioxide is efficiently transported as bicarbonates in the blood. This occurs 70% of the time.

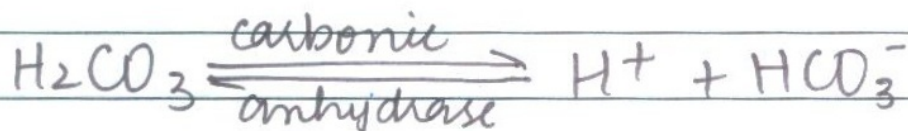


Mechanism:-

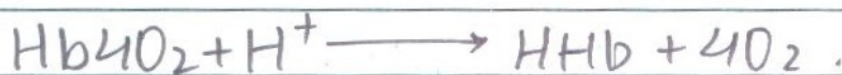
When the  $PCO_2$  in the tissue is higher, the  $CO_2$  diffuses into the erythrocytes where it combines with  $H_2O$  (water) to form carbonic acid in the presence of carbonic anhydrase.



It is unstable so it dissociates to form  $H^+$  &  $HCO_3^-$  (bicarbonate ions).



The  $H^+$  accumulates but is buffered by the haemoglobin as it combines with hydrogen to form haemaglobinic acid, releasing oxygen into the tissue.



The bicarbonate ions are transported out of the cell &  $Cl^-$  ions are shifted inside by special bicarbonate-chloride proteins. This phenomenon is called **chloride's shift** or **hamburger's shift**. The  $Cl^-$  ions combine with potassium to form  $KCl$  while the bicarbonate ions combine with sodium to form sodium bicarbonate. Thus in this way the Haemoglobin buffers the solution and the pH is maintained.

Q. No. 6 (Page 3) (2) As carbony haemoglobin: this forms only under high  $PCO_2$  in the tissues and dissociates under low  $PCO_2$  in the tissue such as the lung tissue. This process occurs 23% of the time.

(3) As being dissolved in the plasma. This is the most inefficient way and occurs only 7% of the time.

