Benha University **Post Graduate Student**

Faculty of Agriculture **Second Term - June 2013**

Animal Production Department **Fish Physiology**

نموذج إجابة امتحان فسيولوجيا الأسماك **Time : 2 hours**

Answer the following question:

First question: Write a short essay on 2 (Two) only of the following :(20 Marks.)

1- The major features of the fish circulatory system.
2- Osmoregulation in fresh water and salt water fishes.
3- The respiratory system in fish.
4- Factors influencing disease resistance and immune response of Fish.

إجابة السؤال الأول :

1- The major features of the fish circulatory system

Circulation

Fish have a closed-loop circulatory system.

The heart pumps the blood in a single loop throughout the body.

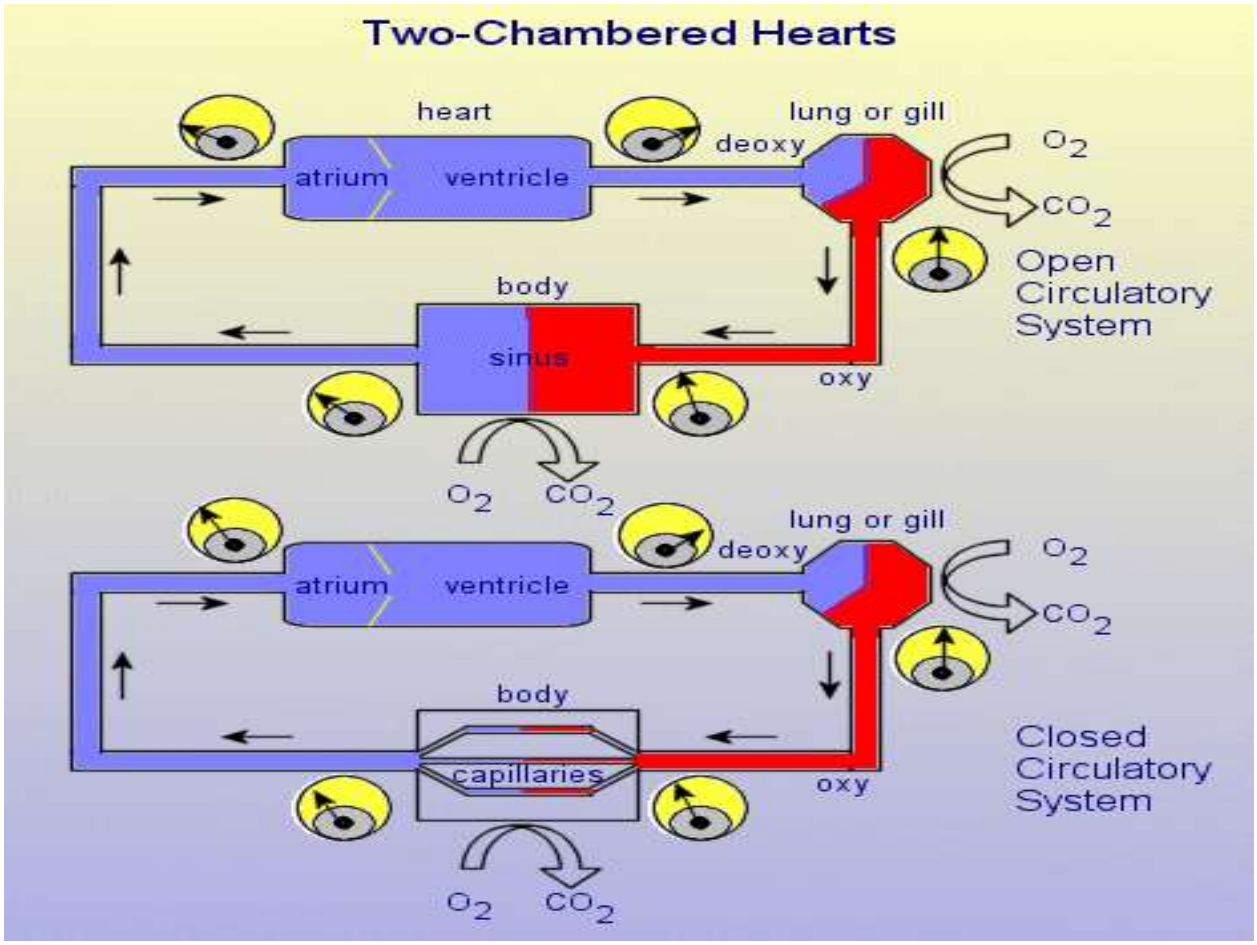
In most fish, the heart consists of four parts, including two chambers and an entrance and exit.

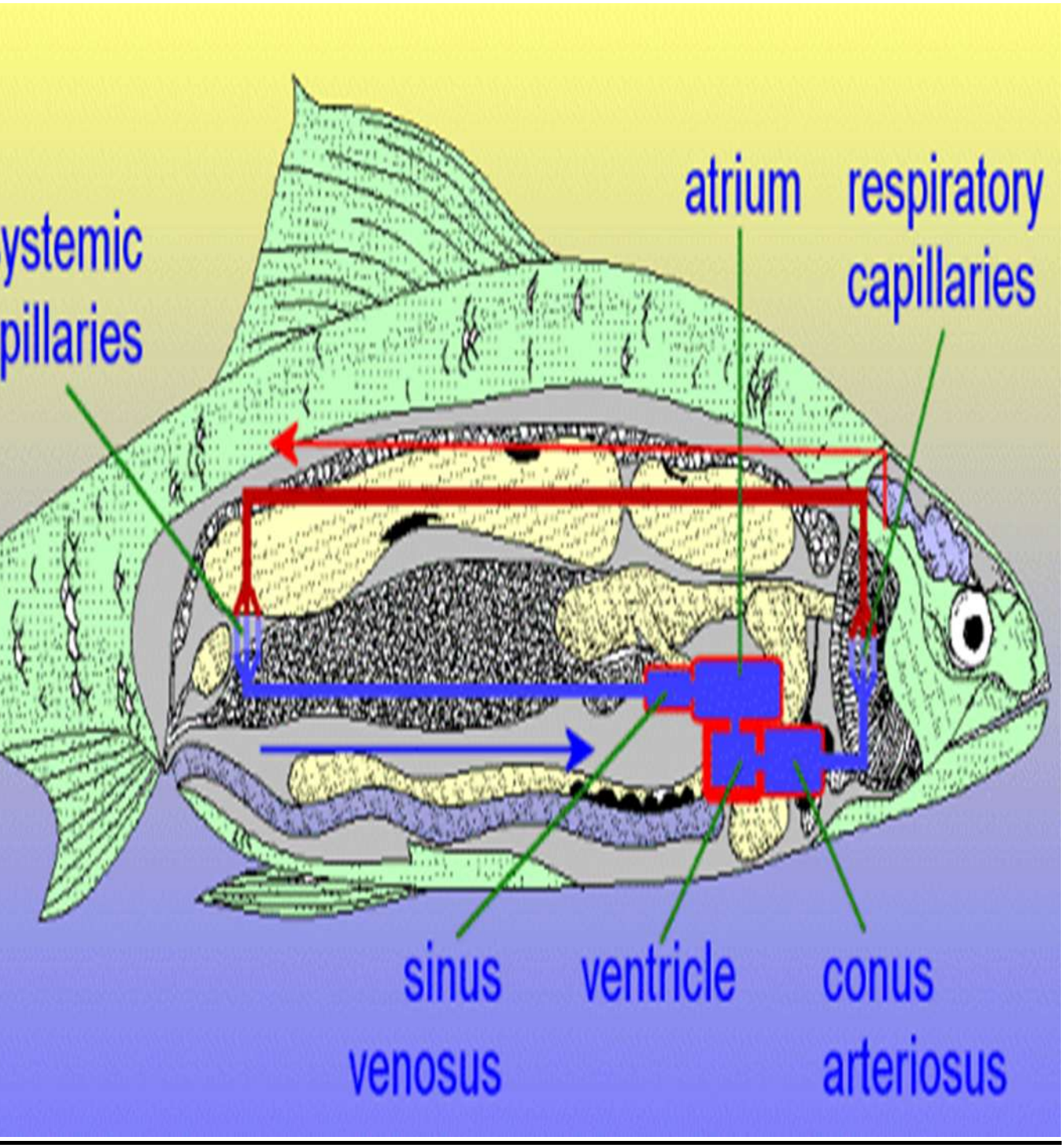
The first part is the sinus venosus, a thin-walled sac that collects blood from the fish's veins before allowing it to flow to the second part, the atrium, which is a large muscular chamber.

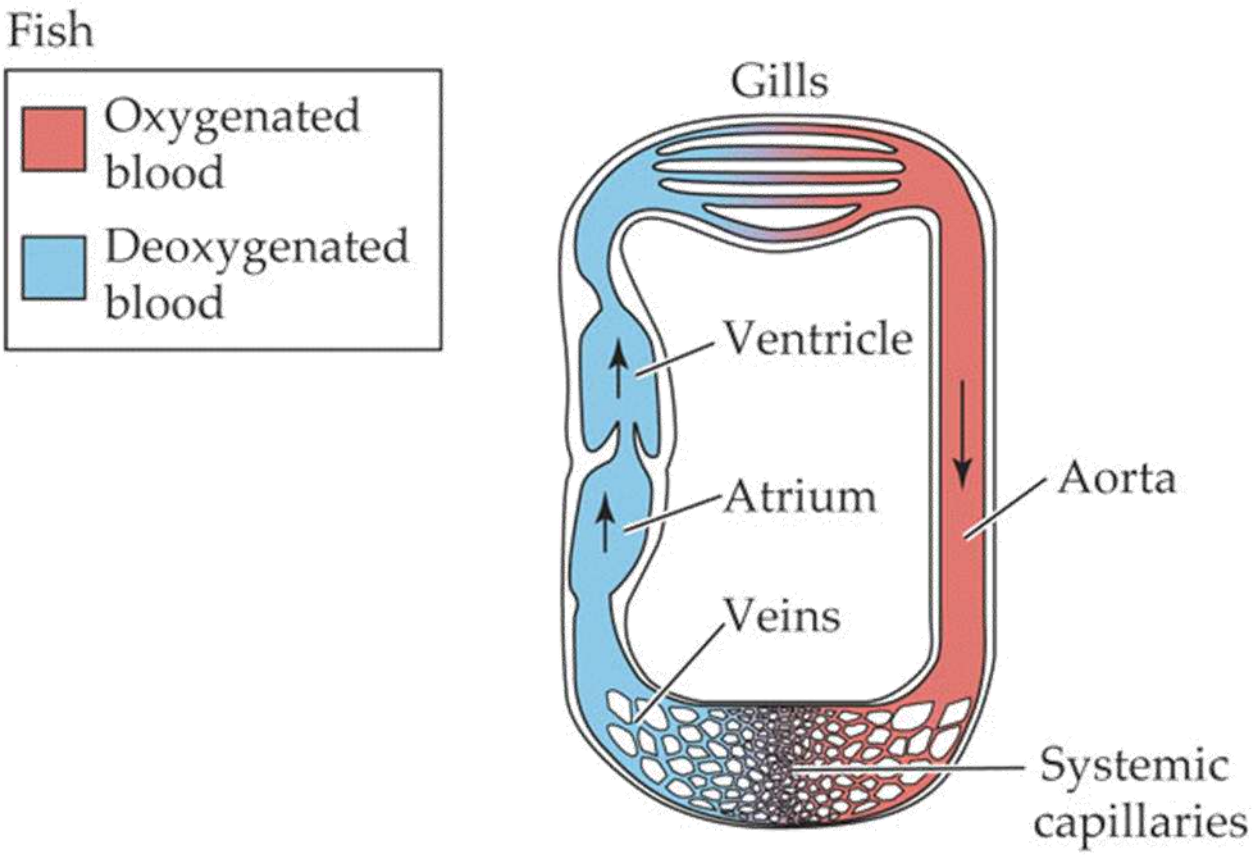
The atrium serves as a one-way antechamber, sends blood to the third part, ventricle.

The ventricle is another thick-walled, muscular chamber and it pumps the blood, first to the fourth part, bulbous arteriosus, a large tube, and then out of the heart.

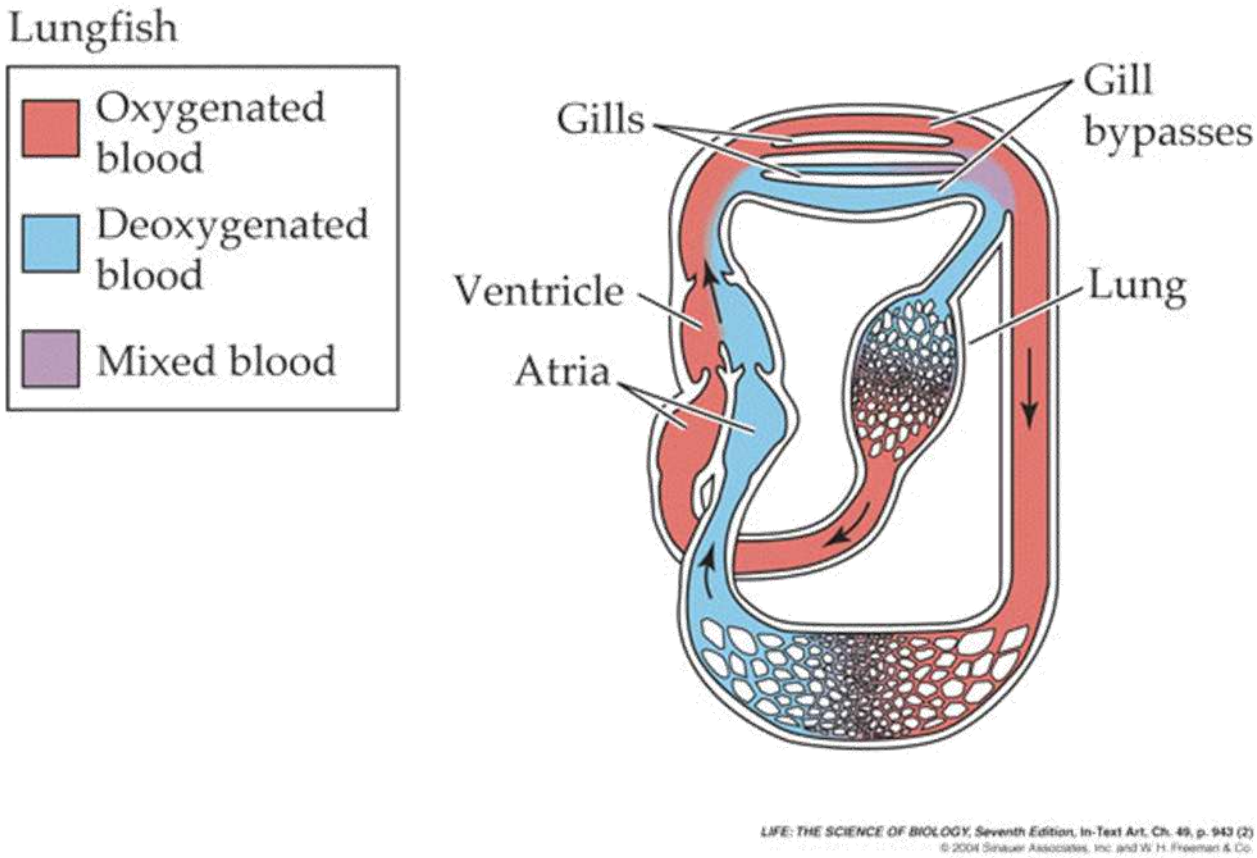
The bulbus arteriosus connects to the aorta, through which blood flows to the gills for oxygenation.


Two-Chambered Hearts
heart
atrium
ventricle
lung or gill
deoxy
O_2
CO_2
Open Circulatory System
body
sinus
oxy
O_2
CO_2
lung or gill
deoxy
atrium
ventricle
O_2
CO_2
body
capillaries
oxy
Closed Circulatory System
O_2
CO_2


ystemic
pillaries
atrium
respiratory
capillaries
sinus
venosus
ventricle
conus
arteriosus



LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, In-Text Art, Ch. 49, p. 943 (1)

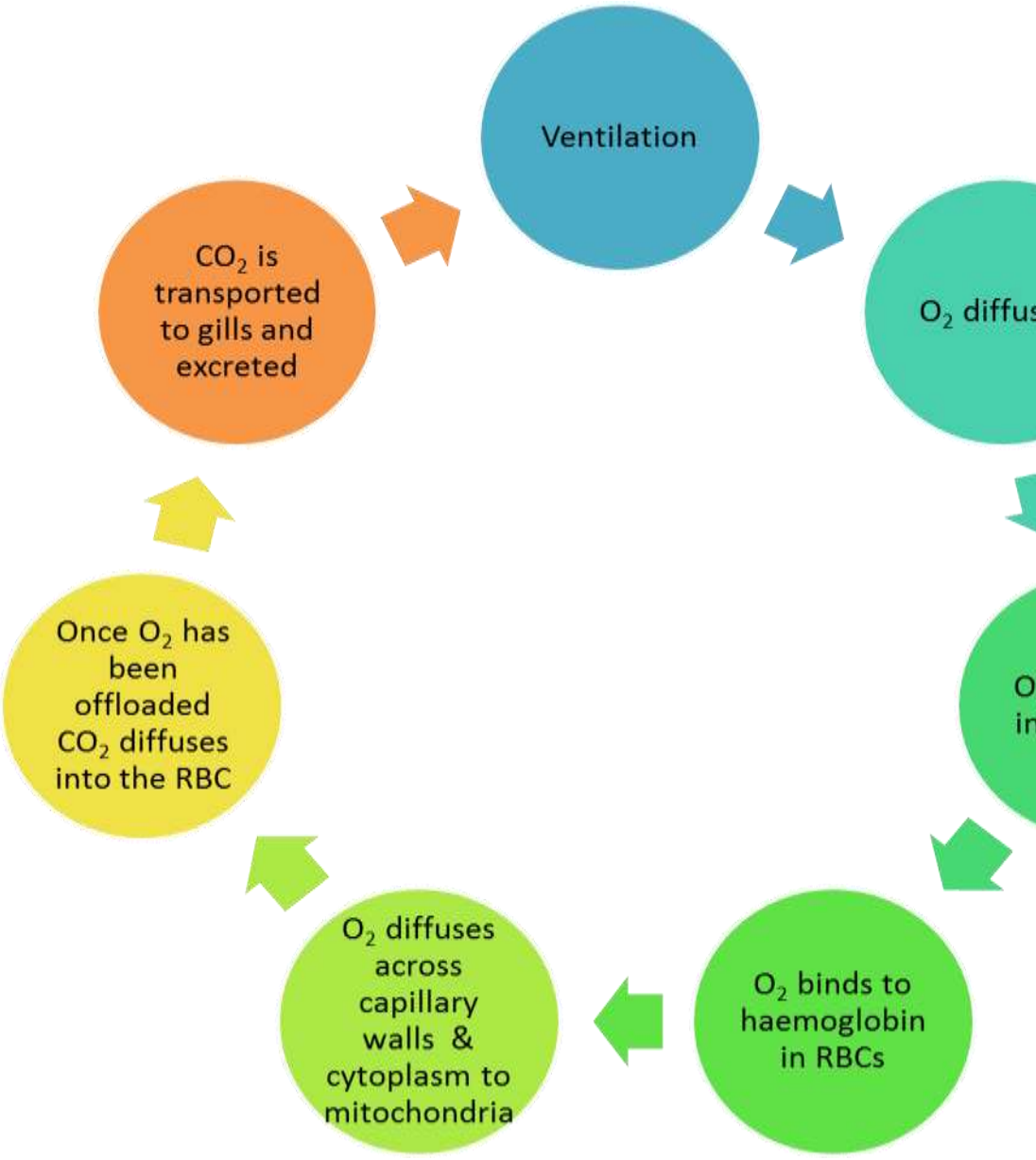


2- **Osmoregulation in fresh water and salt water fishes.**

Challenge to homeostasis depends on
steady state concentration of solutes in the body fluids and tissues as well as
concentration of solutes in the external environment
marine systems: environment concentration = 34 - 36 parts per thousand salinity = 1000 mosm/l
freshwater systems: environment concentration < 3 ppt = 1 - 10 mosm/**l**
Each species has a range of environmental osmotic conditions in which it can function:
stenohaline - tolerate a narrow range of salinities in external environment - either marine or freshwater ranges
euryhaline - tolerate a wide range of salinities in external environment - fresh to saline:
short term changes: estuarine - 10 - 32 ppt, intertidal - 25 - 40
long term changes: diadromous fishes

3- <u>The respiratory system in fish.</u>

Countercurrent blood flow increases the efficiency of obtaining O2 from water



Carbon dioxide transport – the chemistry of CO2 in water

Carbonic anhydrase speeds up carbon dioxide dissociation in the cell

Carbonic anhydrase speeds up carbon dioxide dissociation at the tissues

Carbonic anhydrase speeds up carbon dioxide dissociation at the gills

4- Factors influencing disease resistance and immune response of Fish.

Factors Influencing Disease Resistance and Immune Response of Fish1

General	Specific
Genetics	Individuals may exhibit differences in innate resista acquired immunity
Environment	Temperature, season, photoperiod
Stress	Water quality, pollution, density, handling and tran breeding cycles
Nutrition	Feed quality and quantity, nutrient availability, use immunostimulants, antinutritional factors in feeds
Fish	Age, species or strains, individuals
Pathogen	Exposure levels, type (parasite, bacterial, viral)

Resting fish body temperature is near ambient
pathogen generation time is temperature dependent
fishes living in cold temperatures have little need for an immune response

coldwater fishes do not produce immunoglobulins
immune response slower at cold temperatures (up to 28 days!)

Immune competency develops relatively slowly in animals
mammals obtain antibodies through mother's milk for up to six weeks
not the case with fish
rainbow trout are found to be immune competent at an early age (0.3g(
significance: immunization of very young fish is practical

Second question :Define 8 (Eight) only of the following:(20 D.)

1- Solute homeostasis.	2- Pyloric ceca.
3- Gas bladder.	4- Gonads.
5- Hematopoiesis.	6- Corpuscles of stannous.
7- Humoral immunity.	8- Innate immunity.
9- B-Lymphocytes.	10- T-Lymphocytes.

اجابة السؤال الثانى

1- Solute homeostasis:
Solute homeostasis = maintaining equilibrium with respect to solute (ionic and neutral solutes) concentrations

2- Pyloric ceca
At the end of the stomach many bony fishes have blind sacs called pyloric caeca . the pyloric caeca are an adaptation for increasing the gut area ; hey digest food .

3- Gas bladder.

4- Gonads.
gamete and sex hormone production
controls gametes maturation
cause formation of secondary sex characteristics: color, shape, behavior
in fish, several sex hormones also serve as pheromones - e.g. goldfish males respond to hormones released with ovulation

5- Hematopoiesis.

hematopoiesis, occurs especially spleen, kidney

hematopoietic activity is not found in medullary cavity of) (bones

6- Corpuscles of stannous.
7- produce stanniocalcin - controls Ca+2 inflow at gills

8- Humoral immunity.
Humoral (protects against bacteria and viruses present in body fluids)

9- Innate immunity.
innate or natural immunity: attributed to inherited ability to produce antibodies without stimulation by antigens

10- B-Lymphocytes.
–Humoral immune system
–Have surface receptors that recognize antigens
–Once foreign object is encountered they move to lymph tissue and form daughter lymphocytes
–Daughter cells produce specific antibodies to foreign antigen
– Some will develop into memory cells

11- T-Lymphocytes.

– Cell mediated immunity
–Interact with antigens on cells that have been infected and cancer cells
–Actively remove antigens
3 –Types :
•Cytotoxic T-cells (killer) – directly terminate antigens
•Helper T-cells -precipitates production of antibodies by B-cells
• Memory T-cells

Third question: Answer 10 (Ten) only of the following:(20 D.)

1-Herbivorous fish have a short digestive tract when compared with carnivorous fish (True or False).
2-In saltwater fish, the kidney saves ions and excretes water (True or False).
3-The majority of nitrogenous waste is excreted through the kidney (True or False).
4-When the pH is acidic (<7) the ammonium ion is quickly turned to ammonia, which is deadly for the fish (True or False).
5-Corpuscles of stannous are located in pancreas (True or False).
6-The Fish blood have thrombocytes (no platelets)-(True or False).
7-The parathyroid glands are absent in fish (True or False) .
8-A primary function of the kidney is osmoregulation (True or False).
9-Countercurrent blood flow increases the efficiency of obtaining oxygen from water (True or False).
10-Nitrite and ammonia are very toxic to fish (True or False).
11-Ammonium is an ion that is fairly toxic to fish (True or False).
12-Water flows over gills as fish opens mouth and swims (True Or False).
13-Fish have both non-specific and acquired immunity responses (True or False).
14-Water flows opposite direction of blood flow (True or False).
15-Gills are made of hundreds of gill filaments (True or False).

اجابة السؤال الثالث :

1- False
2- False
3- False
4- False
5- False
6- True
7- True
8- True
9- True
10- True
11- True
12- True

13- True
14- True
15- False

Good luck,,,
Prof.Dr.Abdelkarim I.M. El-Sayed