

Fundamental Of Biology, 2010 – IPSE FPMIPA UPI

By: Rini Solihat, S.Pd, M.Si

I. The science of Biology

Define the scope of Biology
Draw mind map of biology
Discuss connection of biology and everyday life
Explain process of science
Design simple biology project

II. Cell structure and function

Define definition of the cell
Discuss the theory that living organism are composed of cells
Distinguish prokaryotic and eukaryotic cell
Compare the specific organelle which is existing in plant and animal cells
State one function of each plant and animal cells organelle
Identify and use part of the microscope
Explain the function of each part microscope
Prepare and Observe a Wet Mount under microscope
Draw Prokaryotic cell under microscope
Annotate the object which was drawn
Discuss the observation result
Construct Laboratory report

III. Cellular metabolism

Define *enzyme* and *active site*.
Explain the effects of temperature, pH and substrate concentration on enzyme activity.
Distinguish anabolism and catabolism
Define *cell respiration*
Explain that in anaerobic cell respiration pyruvate is converted into lactate or ethanol and carbon dioxide in the cytoplasm, with no further yield of ATP
Explain that in aerobic cell respiration pyruvate is broken down in the mitochondrion into carbon dioxide and water with a large yield of ATP.
State that photosynthesis involves the conversion of light energy into chemical energy
State that chlorophyll is the main photosynthetic pigment.
State that light energy is used to split water molecules (photolysis) to give oxygen and hydrogen, and to produce ATP.
State that ATP and hydrogen (derived from the photolysis of water) are used to fix carbon dioxide to make organic molecules
Explain that the rate of photosynthesis can be measured directly by the production of oxygen or the uptake of carbon dioxide, or indirectly by the increase in biomass.
Outline the effects of temperature, light intensity and carbon dioxide concentration on the rate of photosynthesis.
Observe the effect of light on photosynthesis

IV. Cellular reproduction

State that the cell-division cycle involves interphase, mitosis and cytokinesis.
Describe the events that occur in the four phases of mitosis (prophase, metaphase, anaphase and telophase).

Explain how mitosis produces two genetically identical nuclei
Outline the differences in mitosis and cytokinesis between animal and plant cells
State that meiosis is a reduction division in terms of diploid and haploid numbers of chromosomes.
Outline the process of meiosis, including pairing of chromosomes followed by two divisions, which results in four haploid cells.
State that tumours (cancers) are the result of uncontrolled cell division and that these can occur in any organ

V. Genetics

State that eukaryote chromosomes are made of DNA and protein.
Define *gene*, *allele* and *genome*.
Outline DNA nucleotide structure in terms of sugar (deoxyribose), base and Phosphate
Draw a simple diagram of the molecular structure of DNA.
Compare the structure of RNA and DNA
Define: *genotype*, *phenotype*, *dominant allele*, *recessive allele*, *codominant alleles*, *locus*, *homozygous*, *heterozygous*, *carrier* and *test cross*.
Construct a pedigree chart.
Constructing Punnet Square
State that some genes have more than two alleles (multiple alleles).
Describe ABO blood groups as an example of codominance and multiple alleles
Calculate and predict the genotypic and phenotypic ratios of offspring of monohybrid crosses involving any of the above patterns of inheritance.
Deduce the genotypes or phenotypes of individuals in pedigree charts.
State two examples of the current uses of genetically modified crops or animals.
Discuss the potential benefits and possible harmful effects of one example of genetic modification.
Discuss the ethical issues of cloning in humans.

MID TEST

VI. Evolutionary biology and Biodiversity

Define *evolution*.
State that populations tend to produce more offspring than the environment can support.
Explain that the consequence of the potential overproduction of offspring is a struggle for survival.
State that the members of a species show variation.
Explain how sexual reproduction promotes variation in a species.
Explain how natural selection leads to the increased reproduction of individuals with favourable heritable variations.
Discuss the theory that species evolve by natural selection.
Explain two examples of evolution in response to environmental change; one must be multiple antibiotic resistance in bacteria.
Define *species*.
Describe the value of classifying organisms.
Outline the binomial system of nomenclature.
State that organisms are classified into the kingdoms Prokaryotae, Protoctista, Fungi, Plantae and Animalia.
List the seven levels in the hierarchy of taxa—kingdom, phylum, class, order, family, genus and species—using an example from two different kingdoms for each level.
Apply and/or design a key for a group of up to eight organisms.

VII. Plant; structure, reproduction,development

Outline the wide diversity in the plant kingdom as exemplified by the structural differences between bryophytes, filicinophytes, coniferophytes and angiospermophytes.

Draw a diagram to show the external parts of a named dicotyledonous plant.

Draw plan diagrams to show the distribution of tissues in the stem, root and leaf of a generalized dicotyledonous plant.

Explain the relationship between the distribution of tissues in the leaf and the functions of these tissues.

Draw the structure of a dicotyledonous animal-pollinated flower, as seen with the naked eye and hand lens.

Define *pollination*.

Distinguish between pollination, fertilization and seed dispersal.

Draw the external and internal structure of a named dicotyledonous seed.

Explain the conditions needed for the germination of a typical seed.

VIII. Plant: nutrition, transport and control system in plants

Explain how the root system provides a large surface area for mineral ion and water uptake by means of branching, root hairs and cortex cell walls.

Describe the process of mineral ion uptake into roots by active transport.

Explain the process of water uptake by root epidermis cells and its movement by the symplastic and apoplastic pathways across the root to the xylem.

Define *transpiration*.

Explain how water is carried by the transpiration stream, including the structure of xylem vessels, transpiration pull, cohesion and evaporation.

Explain how the abiotic factors, light, temperature, wind and humidity, affect the rate of transpiration in a typical terrestrial mesophytic plant.

Describe an example of food storage in a plant.

IX. Animals; Hierarchy of animal structure, Nutrition and Digestion

Explain why digestion of large food molecules is essential.

Explain the need for enzymes in digestion.

State the source, substrate, products and optimum pH conditions for one amylase, one protease and one lipase.

Draw a diagram of the digestive system.

Outline the function of the stomach, small intestine and large intestine.

Distinguish between absorption and assimilation.

Explain how the structure of the villus is related to its role in absorption of the end products of digestion

X. Animals; Circulation and Gas Exchange

Draw a diagram of the heart showing all four chambers, associated blood vessels and valves.

Describe the action of the heart in terms of collecting blood, pumping blood and opening and closing valves.

Outline the control of the heartbeat in terms of the pacemaker, nerves and adrenalin.

Explain the relationship between the structure and function of arteries, capillaries and veins.

State that blood is composed of plasma, erythrocytes, leucocytes (phagocytes and lymphocytes) and platelets.

State that the following are transported by the blood: nutrients, oxygen, carbon dioxide, hormones, antibodies and urea.

List the features of alveoli that adapt them to gas exchange.

State the difference between ventilation, gas exchange and cell respiration.

Explain the necessity for a ventilation system.

Draw a diagram of the ventilation system including trachea, bronchi, bronchioles and lungs.

Explain the mechanism of ventilation in human lungs including the action of the internal and external intercostal muscles, the diaphragm and the abdominal muscles.

XI. Animals: Homeostasis and Excretions

State that homeostasis involves maintaining the internal environment at a constant level or between narrow limits, including blood pH, oxygen and carbon dioxide concentrations, blood glucose, body temperature and water balance.

Explain that homeostasis involves monitoring levels of variables and correcting changes in levels by negative feedback mechanisms.

State that the nervous and the endocrine systems are both involved in homeostasis.

Describe the control of body temperature including the transfer of heat in blood, the role of sweat glands and skin arterioles, and shivering.

XII. Animals; Excretions and Reproduction

Define *excretion*

Outline the need for excretion in all living organisms.

State that excretory products in plants include oxygen, and in animals they include carbon dioxide and nitrogenous compounds.

Draw the structure of the kidney.

Outline the role of the kidney in excretion and the maintenance of water balance.

Define *osmoregulation*.

Compare the composition of blood in the renal artery and renal vein, and compare the composition of glomerular filtrate and urine.

Draw diagrams of the adult male and female reproductive systems.

Explain the role of hormones in regulating the changes of puberty (testosterone, estrogen) in boys and girls, and in the menstrual cycle (folliclestimulating hormone (FSH), luteinizing hormone (LH), estrogen and progesterone).

List the secondary sexual characteristics in both sexes.

Describe early embryo development up to the implantation of the blastocyst.

State that the fetus is supported and protected by the amniotic sac and amniotic fluid.

State that materials are exchanged between the maternal and fetal blood in the placenta.

Outline the process of birth and its hormonal control, including progesterone and oxytocin.

Discuss the ethical issues of family planning and contraception.

XIII. Animals; Immune and Nervous System

Outline the general organization of the human nervous system including the CNS (brain and spinal cord) and the PNS (nerves).

Draw the structure of a motor neuron.

Define *resting potential* and *action potential*.

Explain how a nerve impulse passes along a non-myelinated neuron (axon).

Explain the principles of synaptic transmission.

XIV. Ecology; biosphere and conservation biology

Define *ecology*, *ecosystem*, *population*, *community*, *species* and *habitat*.

Explain how the biosphere consists of interdependent and interrelated ecosystems.

Define *autotroph* (producer), *heterotroph* (consumer), *detritivore* and *saprotroph* (decomposer).

Describe what is meant by a food chain giving three examples, each with at least three linkages (four organisms).

Describe what is meant by a food web.

Deduce the trophic level of organisms in a food chain and a food web.

Construct a food web containing up to 10 organisms, given appropriate information.

Explain the energy flow in a food chain.

Explain what is meant by a pyramid of energy and the reasons for its shape.

Explain that energy can enter and leave an ecosystem, but that nutrients must be recycled.

Draw the carbon cycle to show the processes involved.

Outline how population size can be affected by natality, immigration, mortality and emigration.

Outline two local or global examples of human impact causing damage to an ecosystem or the biosphere. One example must be the increased greenhouse effect

FINAL TEST