WASSCE / WAEC Integrated Science Nov / Dec 2012 Past Questions and Answers (Theory)

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1. a) i) Name **three** products from the fractional distillation of crude oil.
   ii) State **one** use of **each** of the products named in (a) (i).

   b) State **four** measures to be adopted to ensure the maintenance of proper sanitation in a community.

   c) i) State **two** conditions necessary for a solid to float in a liquid.
   ii) A solid of mass 450 kg has a volume of 250 cm³. Calculate the relative density of the solid. [Density of water = 1000 kg m⁻³]

   d) i) What are *layers* as used in poultry production?
   ii) If 600 eggs are collected daily from a poultry house of 900 birds:
   α) determine the laying percentage;
   β) what information could be derived from the laying percentage value?

Solution

a)

Name of product	Uses of product
Gasoline or petrol	• Fuel for car engines • Solvents for paints
Kerosene or paraffin oil	• Fuel for jet engines • Fuel for lamp or stove • As a solvent
Diesel or gas oil	• Fuel used in diesel engines or ships • Fuel for heating furnace
Lubricating oils or grease	• Lubricating car engines or metal joints
Petroleum jelly	• For medical purposes or for making pomade • For lubrication
Paraffin wax	• For making candles • For making water proofing paper
Bitumen	• For road construction • For roofing
Petroleum gases or methane or ethane or propane or butane or LPG	• Fuels for cooking or lighting • Fuel for heating furnace

b) *Measures to ensure maintenance of proper sanitation in a community*
   - Provision of waste and refuse containers.
   - Proper siting of refuse dumps.
   - Cleaning homes.
   - Cleaning public places of convenience.
   - Proper planning of houses to ensure good ventilation.
   - Weeding and clearing of bushes around houses.
   - Provision of clean and safe water supplies.
   - Proper management of sewage disposal.
   - Efficient collection and disposal of refuse.
   - Cleaning and de-silting gutters.
   - Destruction or draining of stagnant waters.

c) i) *Conditions for a solid to float in a liquid*
   - When the solid displaces its own weight of the liquid in which it floats.
   - When the density of the solid is less than that of the liquid.
   - When the density of the solid is equal to the density of the liquid.

   ii) Density of wood

   $$= \frac{Mass}{Volume}$$

   $$= \frac{450\,kg}{250\,cm^3}$$

   $$= \frac{450\,kg}{0.00025\,m^3} = 1.8 \times 10^6\,kgm^{-3}$$

Relative density

$$= \frac{\text{Density of solid}}{\text{Density of water}}$$

$$= \frac{1.8 \times 10^6 \, \text{kgm}^{-3}}{1000 \, \text{kgm}^3} = 1.8 \times 10^3$$

d) i) Layers are domestic birds which lay eggs.

ii) α) Laying percentage $= \frac{600}{900} \times 100\%$

$$= \frac{600}{900} \times 100\%$$

$$= 67\%$$

β) It gives information on the performance of the birds.

2. a) i) What is *discontinuous variation*?
   ii) List **three** examples of discontinuous variation in humans.

b) i) Define an *electric current*.
   ii) An electrical circuit consists of two resistors of resistances 25 Ω and 45 Ω in series with a cell of emf 2 V. Calculate the current flowing through the circuit.

c) Explain in **three** ways how cover cropping aids in the maintenance of soil fertility.

d) i) What is *covalent bond*?
   ii) List two examples of chemical compounds which contain covalent bonds.

Solution
a) i) Discontinuous variation is a type of variation that shows clear cut difference between characters with no intermediate forms.

ii) *Examples of discontinous variation*
   − Rhesus factor
   − Blood groups
   − Sex
   − Sickle cell anaemia
   − Haemophilia
   − Colour blindness
   − Tongue rolling
   − Ability to taste

b) i) Electric current is the flow of electric charges or electrons. **OR**
   It is the rate of flow of charges.

ii) Total resistance = 25 Ω + 45 Ω = 70 Ω

$$\text{Current} = \frac{\text{Voltage}}{\text{Resistance}} = \frac{2}{70} = 0.03 \, \text{A}$$

c) *Ways in which cover cropping aids in soil fertility*
   − Conserving soil moisture by drastically reducing evaporation from the soil.
   − Smothering weeds to control them or to prevent nutrients uptake by weeds.
   − Fixing nitrogen thereby adding nutrients to the soil.
   − Preventing soil erosion to maintain nutrients in the top soil.
   − Cooling the soil to create the right conditions for soil organisms.
   − Litter from cover crops constitutes a good source of soil organic matter.

d) i) Covalent bond involves the sharing of electrons between the atoms. **OR**
   It involves the sharing of electron pair between two atoms.

ii) *Examples of chemical compounds with covalent bonds*
   − chlorine or Cl_2
   − hydrogen or H_2
   − hydrogen chloride or HCl
   − water or H_2O
   − oxygen or O_2
   − carbon dioxide or CO_2
   − ammonia or NH_3

3. a) i) List **two** types of blood vessels present in mammals.

   ii) Explain how each of the blood vessels listed in (a) (i) is adapted its function.

   b) i) Explain the importance of wearing seat belts in a moving vehicle.

   ii) State the law which explains the answer in (b) (i).

   c) i) Name **two** types of castration performed in animal production.

   ii) State three reasons for castrating farm animals.

   d) i) Name **two** cations which cause hardness in water.

   ii) State **three** advantages of hard water.

Solution

a) i) *Blood vessels in mammals*
   - Artery
   - Vein
   - Capillary

   ii) *Adaptation of the artery to its function*
   - It has a thick or muscular wall to withstand high pressure.
   - The walls are elastic to withstand high pressure.

   Adaptation of the vein to its function
   - It has a thin wall and carries blood at low pressure.
   - They have valves to prevent back flow of blood.

   Adaptation of the capillaries to its function
   - It is thin or small in order to penetrate to all parts of the internal organs or tissue.
   - They have thin walls for easy diffusion of nutrients or waste products

b) i) *Importance of wearing seat belts in a moving vehicle*
   - When the brakes of a moving vehicle are applied suddenly, passenger continue to move at a speed at which the vehicle was travelling.
   - This may cause passengers to hit their heads or bodies against objects in front of them or to be thrown out of the vehicle or to move forward.
   - The seat belts hold passengers firmly to the seat to reduce injuries.

   ii) The Newton's first law of motion states that if an object is stationary it will remain so, and if is moving it will continue to move with constant speed in a straight line unless external forces act on it. **OR**
   The law of inertia states that everybody has the reluctance to move when initially at rest and to stop moving when already in motion.

c) i) *Types of castration*
   - Open or bloody castration.
   - Closed or bloodless castration.

   ii) *Reasons for castrating farm animals*
   - It prevents the indiscriminate mating in the flock or inbreeding.
   - It prevents the spread of venereal diseases.
   - It removes offensive smell in farm animals.
   - There is improvement in the tenderness of meat.
   - It makes handling of animals easier or it makes the animals docile.
   - The animal becomes heavy for meat production.

d) i) *Cations that cause hardness in water*
   - Calcium (ions)
   - Magnesium (ions)

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d) i) *Cations that cause hardness in water*
  – Calcium (ions)
  – Magnesium (ions)

ii) **Advantages of hard water**
  - It provides calcium which is essential for animal growth or essential for strong bones or teeth.
  - Used in the brewery industries because of the pleasant taste.
  - Provides Ca^{2+} ions which help in blood clotting in animals.
  - Reduces heart diseases.
  - Provides Ca^{2+} ions which are used by plants in the manufacture of certain vital substances.
  - It does not cause lead poisoning or lead does not dissolve in water.

4. a) i) Draw and label a vacuum flask.
      ii) Explain briefly how heat losses are minimised in a vacuum flask.

   b) Outline the steps involved in preparing a site for lawn establishment.

   c) Define the following terms:
      i) *isotopes*;
      ii) *mass number*.

   d) i) What is *cross-pollination* as used in plant reproduction?
      ii) State **two** characteristics **each** of flowers pollinated by **each** of the following agents;
         (α) insects;
         (β) wind.

Solution
a) i)
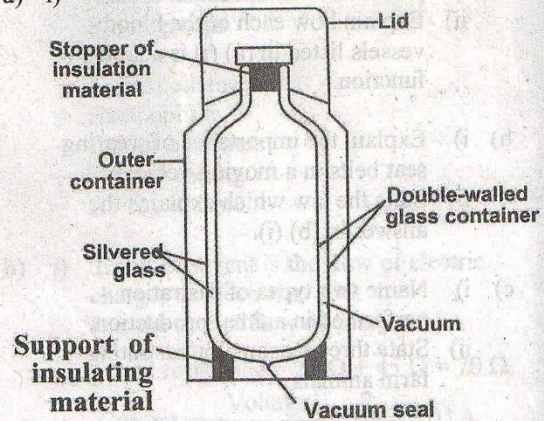
ii) **Explanations of how heat losses are minimised in vacuum flask**
  - The cork support and cork lid prevent heat losses by conduction.
  - Heat loss by conduction is also prevented by vacuum within the double wall of the flask.
  - The vacuum between the double wall of the flask prevents heat loss by convection.
  - The smooth shiny surfaces of the flask reflect back the heat that would have been lost through radiation.

b) i) **Steps involved in preparing a site for lawn establishment**
  - Clearing of vegetation from land.
  - Tevelling or grading of surface of land or digging or ploughing of top soil and removal of rocks or loosening of soil and removal of foreign materials.
  - Adding of black soil or manuring.
  - Watering
  - Allowing land to rest for sometime.

c) i) Isotopes are atoms of the same element having different mass numbers. **OR** They are atoms of the same element having the same number of protons but different neutrons.

ii) Mass number is the sum of the number of protons and the number of neutrons in an atom.

d) i) Cross pollination is the transfer of pollen grains from the anther of a flower to the stigma of another flower of the same plant or to the stigma of another plant of the same species.

ii) (α) *Characteristics of insect pollinated flowers*
   − Large or conspicuous flowers.
   − The petals are brightly coloured.
   − Flowers are scented.
   − Presence of horny guides on petals.
   − Presence of nectarines at the base of the outer stamens.
   − Stamens have short filaments.
   − Pollen grains are large or heavy.
   − Pollen grains are sticky and have rough surface.
   − Pollen grains are produced in small quantities.
   − Stigmas are small and sticky.

(β) *Characteristics of wind pollinated flowers*
   − Small, inconspicuous flowers.
   − The petals are without scent.
   − Absence of nectarines.
   − Presence of large, pendulous stamens.
   − Pollen grains are light and have smooth surfaces.
   − Pollen grains are produced in large quantities.
   − Stigmas are large and feathery.

5. a) i) Distinguish between a *normal salt* and an *acid salt*.
   ii) Give **one** example of **each** type of salt in (a) (i).

   b) i) What is *cereal* as used in crop production?

ii) Name **three** examples of a seed that qualifies to be both a cereal and a grain.

c) i) What is *refraction of light*?
   ii) With the aid of a diagram, show the path of a ray of light as it passes from air into water.

d) i) What is *vegetative reproduction*?
   ii) State **two** reasons **each** why a rhizome could be
   α) regarded as a modified shoot;
   β) used as an organ for vegetative reproduction.

Solution

a) i) A normal salt is the one formed when all the replaceable hydrogen atoms of an acid have been replaced with a metal or ammonium ion whilst an acid salt formed when only part of the replaceable hydrogen atoms in an acid is replaced with a metal or ammonium ion.

ii) *Examples of a normal salt*
   − Sodium chloride or $NaCl$.
   − Calcium tetraoxosulphate (VI) or $CaSO_4$ or calcium sulphate.
   − Zinc chloride or $ZnCl_2$.
   − Potassium chloride or KCl.
   − Ammonium tetraoxosulphate (VI) or $(NH_4)_2SO_4$ or ammonium sulphate.
   − Potassium trioxocarbonate (VI) or K_2CO_3 or potassium carbonate.

   Examples of an acid salt
   − Sodium hydrogen trioxocarbonate (IV) or $NaHCO_3$ or sodium hydrogen carbonate.
   − Potassium hydrogen tetraoxosulphate (VI) or $KHSO_4$ or potassium hydrogen sulphate.
   − Potassium dihydrogen tetraoxophosphate (V) or KH_2PO_4 or potassium dihydrogen phosphate.

b) i) Cereal is a terminology used in classifying plants or crops that produce grains.

   ii) *Seeds that qualify to be both a grain and a cereal*
   - Maize
   - Millet
   - Rice
   - Sorghum
   - Guinea corn

c) i) Refraction of light is the change in the direction of light rays or bending of lights when it travels from one medium to another different optical density.

   ii)
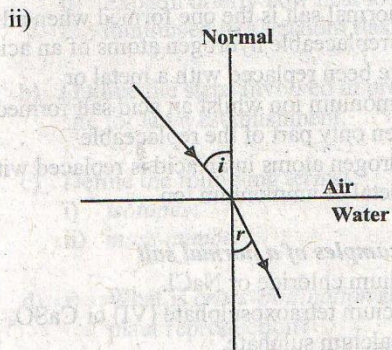
d) i) Vegetative reproduction is the production of new individuals of a particular species of plants by means of parts of a parent plant other than fertilized seeds.

   ii) (α) *Reasons why rhizome is regarded as a modified shoot*
   - Presence of stem.
   - Presence of nodes or internodes.
   - Presence of scale leaves.
   - Presence of adventitious roots.
   - Presence of buds.

(β) *Reasons why rhizome is used as an organ for vegetative reproduction*
   - Presence of auxiliary or terminal bud.
   - Presence of stem swollen with stored food.

6. a) i) What is *vaccination*?
   ii) Explain in **two** ways how the human body defends itself against disease-causing micro-organisms.

   b) i) Distinguish between fish *farming* and *fishing*.
   ii) List **two** types of fishing nets.

   c) i) Define *kinetic energy*.
   ii) An athlete whose mass is 60 kg runs a 200 m race in 30 seconds. Calculate the kinetic energy of the athlete.

   d) i) What is *ventilation*?
   ii) State **three** factors which should be considered during the construction of a well-ventilated house.

Solution

a) i) Vaccination is the injection of dead or weak causative organism to enable the body produce antibodies against diseases caused by the causative organism or increase immunity of the organism.

   ii) *Ways in which the human body defends itself against disease-causing micro-organisms*
   - The skin prevents disease causing organism from entering the body.
   - The white blood cells engulf germs that invade the body.
   - The body produces antibodies which destroy the effect of the toxins produced by the pathogens.

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b) i) Fish farming involves the rearing and management practices of fish whilst fishing involves the skill of hunting for fish in rivers or lakes or ponds or seas.

ii) *Types of fishing nets*
  - Seine net
  - Gill net
  - Scoop net
  - Lift net

c) i) Kinetic energy is the energy possessed by a body by virtue of its motion.

ii) Kinetic energy $= \frac{1}{2}mv^2$

Velocity $= \frac{200}{30} = 6.7$ m/s

$\therefore$ Kinetic energy $= \frac{1}{2} \times 60 \times 6.7^2 = 1346.7$ J

d) i) Ventilation is a process of displacing stale air with fresh air in a room.

ii) *Factors to be considered during construction of a well-ventilated house*
  - The size of windows.
  - Position of windows.
  - Alignment of the building.
  - The direction of wind flow in the house.
  - The number of windows.

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Good luck!