

ANSWERS TO GENERAL PAPER, 2010

1. **D:** The first and second vertebrae of the vertebral column are the **atlas** and **axis** respectively. The atlas has a **large neural canal** and **no centrum**. It produces nodding movements of the head. The axis has a **large centrum** which projects upwards and forward as the **Odontoid process** (also called **Dens**). The axis produces rotation of the head from side to side. The remaining **cervical** vertebrae as well as the **thoracic** and **lumbar** ones have **centrum**.
2. **A:** **Rhizomes** have underground branching stems with lateral and terminal buds and scale leaves, e.g. Ginger, canna lily, certain grasses, ferns, etc.
Tubers may be stem tubers (e.g. yam, Irish potato) or root tubers (e.g. cassava, sweet potato). Stem tubers store their manufactured food in underground stems while root tubers store theirs in the roots. The **Bulb** is an underground condensed shoot with short stem, bearing fleshy and scaly leaf bases with axillary and terminal buds (e.g. onion, garlic, lily).
3. In **Epigeal germination**, the cotyledons are carried above the soil due to rapidly growing hypocotyls. Examples of plants in which, there is epigeal germination are: castor plant, cowpea, pumpkin etc. In **Hypogeal germination**, the epicotyls grow rapidly and elongates leaving the cotyledons in the soil. This is seen in maize, garden peanut, mango, peach, sorghum, rice etc. Groundnut is believed by some authorities to have intermediate germination, however, it has epigeal germination. Most dicots have epigeal germination while most monocots have hypogeal germination.
4. **B:** The **pancreas** has: **A**
 - (i). An **endocrine** part (hormone- producing) and
 - (ii). an **exocrine** part (digestive enzyme-producing).

The endocrine part is responsible for the production of **insulin**, a hormone which lowers blood sugar (glucose), and **glucagon** (another hormone) which raises blood sugar.

The exocrine part produces **pancreatic juice** which is rich in **pancreatic amylases** (e.g. α -amylase), **proteases** (e.g. trypsin, chymotrypsin) and **lipases**. These three major classes of enzymes digest carbohydrates, proteins and lipids respectively. (NB: trypsinogen = insoluble, trypsin = soluble).

The **liver** is responsible for detoxification of harmful substances, deamination of excess amino acids, packaging and re-distribution of absorbed food, production of bile (which is subsequently stored in the gall bladder), removal of worn-out red blood cells etc.

The **spleen** is a lymphoid organ which removes worn-out red blood cells and also plays a role in the body's immune defence.

The **adrenal gland** has a cortex (outer coat) and a medulla (central core). The adrenal cortex produces glucocorticoid steroid hormones such as cortisol, aldosterone and sex hormones. The adrenal medulla produces adrenaline and noradrenaline.

5. **D:** A virus does not have cellular organelles of its own such as ribosomes, nucleus, Golgi body etc. It uses the host cell's machinery to manufacture its component parts.
A virus is basically made up of a **capsid** (protein coat) and genetic material, which may be DNA or RNA, but never both!

Glycogen is the storage form of glucose in animals, while **starch** is the storage form in plants. Viruses do not have any of these. Rather, they closely resemble non-living things.

6. **B:** They are all **living things** and thus share the properties of living things **MR. NIGER D**

M	-	Movement (especially animals)
R	-	Respiration
N	-	Nutrition
I	-	Irritability
G	-	Growth
E	-	Excretion
R	-	Reproduction
D	-	Death

Englena and *Chamydomonas* are simple protists with both animal-like and plant-like properties; they can both move about (mobility) and manufacture their food by photosynthesis (they possess chlorophyll). *Spirogyra*, unlike the others is an algae (simplest plants) which is filamentous in nature.

7. **A:** The molluscs are the "snails"

Nematodes (round worms) have parasitic species such as *Ascaris lumbricoides* (common roundworm), *Dracunculus medinensis* (Guinea worm), *Enterobius vermicularis* (pin worm), *Wuchereria bancrofti* (Filarial worm), *Brugia malayi* (filarial worm), *Ancylostoma duodenale* (Old World hookworm), *Necator americanus* (New World hookworm) *Loa loa* (causes Calabar swelling), *Onchocerca volvulus* (nodular or blinding worm, causes River blindness), *Trichuris trichuria* (whip worm).

The leech, an **annelid**, is an ectoparasite. The earthworm (non-parasite) is another example of an annelid.

8. **A:** **Diploblastic** organisms are those in which the body wall is made up of two layers derived from ectoderm and endoderm.

The **hydra** is a diploblastic organism (just like members of the phylum porifera). It has a radially symmetrical, sac-like body.

Insects are the most numerous and the most successful members of the animal kingdom. They are bilaterally symmetrical and are triploblastic (ectoderm, mesoderm and endoderm are present).

The **roundworms** are bilaterally symmetrical with a false body cavity (pseudocoelom). They reproduce sexually and have separate sexes. They are triploblastic but not segmented. (The annelids, molluscs and arthropods are segmented!).

The amoeba is a **protozoa**.

9. **D:** The "number of an element" refers to its position on the Periodic Table. This is a function of its atomic number (proton number). In this case, the element has 10 protons. Therefore, its position or number is 10.
- NB: (i). Mass number = protons + neutrons ($= 10 + 12 = 22$)
(ii). In the neutral state, the number of protons must equal the number of electrons.
10. **A** e.g. $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O} \rightarrow \text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O} + 9\text{H}_2\text{O}$
Examples of **hygroscopic** substances are: NaNO_3 , CuO , CaO , H_2SO_4 .
Examples of **deliquescent** compounds are: NaOH , KOH , CaCl_2 , MgCl_2 , FeCl_3 and P_2O_5 .
11. **B**
12. **B:** Plastics are produced under high pressure.
13. **B:** = Ammonia.
Sodium hydroxide is used to test for ammonium salts. When the unknown ammonium salt is heated with NaOH , a gas with a characteristic pungent smell, and which turns moist red litmus paper blue is evolved (Ammonia). NB: ammonia is the only alkaline gas.
14. $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
1 mol 1 mol
1 mole of HCl reacts completely with exactly 1 mole of NaOH
Expressing this in mass ("grams")
 36.5g of HCl (1 mole) \rightarrow 40g of NaOH (1 mole)
 $\therefore x\text{g}$ of $\text{HCl} \rightarrow 10\text{g}$ of NaOH
$$x = \frac{36.5 \times 10}{40} = 9.125\text{g}$$

 9.125g of HCl will react completely with 10g of NaOH
15. **A:** **Coordinate-covalent bonding** (dative bonding) is formed between a chemical species having one or more lone-pair of electrons (e.g. H_2O , NH_3 etc), and an electron deficient species e.g. H^+ , BF_3 etc).
Electrovalent (ionic) **bonding** is formed between a strongly electropositive metal and an electronegative non-metal e.g. NaCl , CaF_2 etc.
Simple covalent bonding is formed between two non-metals.
16. **C:** The condensed vapour is the water that it was temporarily dissolved in i.e. the solvent.
Recall: solvent + solute = solutions
17. **B:** The phenomenon is called sublimation (i.e. solid \rightarrow gas, without passing through the liquid phase).
Example of substances that show this property are iodine, ammonium chloride, camphor etc
18. **B:**
 KMnO_4 = Potassium tetraoxomanganate (VII)
 $\text{K}_2\text{Cr}_2\text{O}_7$ = Potassium heptaoxodichromate (VI)
NB:
(i). The 'tetra' before "oxo" is the number of oxygen atoms per molecule e.g. tetraoxo = 4 oxygen atoms, heptaoxo = 7 oxygen atoms
(ii). The Roman numeral in bracket at the end of the IUPAC name represents the oxidation state of the element just before oxygen e.g. dichromate (VI) = oxidation number of chromium is 6.
19.
$$\text{Pressure} = \frac{\text{Force}}{\text{Area}} = \frac{\text{mass} \times \text{acceleration}}{\text{Area}} = \frac{\text{mass} \times \text{displacement}}{\text{length} \times \text{breadth} \times \text{time}^2}$$

Dimensionally: mass = M, length = L, time = T

Thus,
$$\text{Pressure} = \frac{M \times L/T^2}{L \times L} = \frac{MLT^{-2}}{L^2} = ML^{-1}T^{-2}$$

20. **B**
A car revolving a circular tract at a uniform speed has a **changing** velocity. The velocity is varying due to a constant change in the direction of the car. Thus, (i) is incorrect.
It is also the true that in an unbanked (unslanted) curve in a circular path, the centripetal force that prevents skidding is provided by the frictional force between the tyres and the road. Thus option (iii) is correct.

21. **C**
Work done on a body is given as the product of force and its perpendicular distance i.e. $W = F \times d$. However, from the question, force is known while distance is unknown. So, we'd find distance using an equation of motion, since we already have the suitable parameters.

From the parameters provided, the suitable equation of motion will be:

$$s = ut + \frac{1}{2}at^2 \quad u = 0 \text{ (since the body was at rest), } a = 0.2 \text{ m/s}^2 \text{ and } t = 5s$$

$$s = 0 \times 5 + \frac{1}{2} \times 0.2 \times 5^2$$

$$s = \frac{1}{2} \times 0.2 \times 25 = 2.5m$$

Work done, $W = F \times d = 50 \times 2.5 = 125J$

22. **C**

23. **B:** **Leaching** describes the seeping downwards of soil nutrients, away from the reach of the plant roots. A leached soil lacks basic plant nutrients/minerals.

Bush burning destroys the naturally occurring plants and animals (including insects, microorganisms, earthworms etc) on a piece of land. It also destroys the organic materials (humus) required to replenish the soil nutrients.

Grazing refers to allowing domestic herbivores (e.g. cattle, goats, sheep) to feed on plants on a piece of land. This exposes the soil to the drying effects of the sun and may increase leaching.

Cover-cropping involves planting cover crops such as sweet potato, melon etc to keep the soil moist and help replenish its nutrients. Cover-cropping also increases the organic matter content of soil.

24. The resistance of a wire is given by: $R = \frac{\rho l}{A}$

Where: ρ (resistivity) depends on the material of the wire.
 L = length
 A = area.

From the relationship above, resistance is **directly** proportional to the length and **inversely** proportional to the area.

The **lowest resistance** is therefore provided by a short and thick wire

25. Conversion formula Kelvin = $^{\circ}C + 273$
 $= 45 + 273 = 318K$

26. **B:** Brucellosis, a disease of cattle is caused by *Brucella abortus*. It causes abortion in cattle.

27. **D:** See Q. 54, (2005)

28. **D:** Cathode rays are fast-moving electrons and they originate from the cathode (negative electrode) and move towards the anode (positive electrode). The cathode ray tube is the fore-runner of the modern-day television set.

29. **B:** **Humidity** is a measure of the moisture (water content) of the air/atmosphere; the environment is very humid when there is a high level of moisture e.g. immediately after a rainfall. In this case the humidity is high.

On the hand, humidity is said to be low when there is little water content in air e.g. on a very hot afternoon during the dry season or in the harmattan season. The desert has little or no humidity. The rate of evaporation from a pond is thus dependent on the humidity of air, if it is high, there is slow rate of evaporation; if it is low, there is fast rate of evaporation.

30. **C:** The turgidity of the **guard cells** controls the opening and closing of the stomata. The turgidity is low in hot dry conditions, causing a closure of the stomata so as to conserve water for the plant.

31. Total number of students that turned up = $\{\square\} = 1234$

Number of students for opening ceremony = $\{800\}$

Number of students for Novelty match = $\{600\}$

Number of students who did not attend any = 0 {because a student attended at least one of the functions}

Let opening ceremony = C and Novelty match = N . from the formula

$$\square = (C \cup N) - (C \cap N) + (C \cap N) + (C \cup N) \square$$

$$1234 = 800 - x + 600 + 0$$

$$1234 = 800 - x + 600$$

$$1234 = 1400 - x$$

$$x = 1400 - 1234 = 166$$

\therefore 166 students attended both functions.

Note: \square = All students involved

$(C \cup N)$ = Student who attended opening ceremony alone

$(C \cap N)$ = Students who attended both ceremonies

$(C \cap N)$ = Students who attended the Novelty match alone

$(C \cup N) \square$ = Students who did not attend any of the functions.

A good knowledge of Set theory is required here.

32. To choose 3 males from 6 females we have

$${}^6C_3 = \frac{6!}{(6-3)!3!} = \frac{6!}{3!3!} = \frac{6 \times 5 \times 4 \times 3!}{3 \times 2 \times 1 \times 3!} = 20 \text{ ways}$$

To choose 2 females from 4 we have

$${}^4C_2 = \frac{4!}{(4-2)!2!} = \frac{4!}{2!2!} = \frac{4 \times 3 \times 2!}{2 \times 1 \times 2!} = 6 \text{ ways}$$

To choose 3 males AND 2 females:

Number of ways of choosing males \times number of ways of choosing females = $20 \times 6 = 120$ ways.

Note: AND $\Rightarrow \times$ (multiplication)

OR $\Rightarrow +$ (addition)

33. An exterior angle of a regular polygon must be a factor of 360; so any of the options which is not a factor of 360 is wrong!

Reason: The sum of the exterior angles of a regular polygon = 360 and all the exterior angles of a regular polygon are equal. Note also, however that a polygon is a shape bounded by straight lines; hence the least number of straight lines that can make up a polygon is 3 (triangle). The triangle is the simplest polygon.

This also implies that the largest exterior angle a polygon can have is $\frac{360^\circ}{3} = 120^\circ$ (triangle)

An exterior angle of a polygon cannot be 180°

D

34. The question implies

$$\sqrt{x^2 + 9} = x + 1$$

Squaring both sides:

$$x^2 + 9 = (x + 1)^2$$

$$x^2 + 9 = x^2 + 2x + 1$$

$$2x + 1 = 9$$

$$\therefore x = \frac{9-1}{2} = \frac{8}{2} = 4 \quad x = 4$$

35.

$$\frac{3}{5} \div \left(\frac{2}{7} \times \frac{4}{3} \div \frac{4}{9} \right)$$

$$\frac{3}{5} \div \left(\frac{2}{7} \times \frac{4}{3} \times \frac{9}{4} \right)$$

$$\frac{3}{5} \div \left(\frac{2}{7} \times \frac{3}{1} \right)$$

$$\frac{3}{5} \div \left(\frac{6}{7} \right) = \frac{3}{5} \times \frac{7}{6} = \frac{7}{10}$$

B

36. C: Radial symmetry implies that the organism may be cut into two equal halves in more than one plane (i.e. several planes). Hydra (coelenterate) and sponges (porifera) are radially symmetrical, while the other organisms listed are bilaterally symmetrical.

37. Sudan III solution is used to test for fats. When a few drops of Sudan III solution is added to food containing fat, a red precipitate is formed, which turns black on boiling.

D

Simple reducing sugars such as glucose, fructose and galactose are tested for using:

- Fehling's Solution
 - Benedict's Solution
- } Orange-red precipitate forms

Complex sugars are tested for using dilute HCl and Fehling's solution. The HCl hydrolyzes the complex sugar to simple reducing sugars and the Fehling's solution tests for them (orange-red precipitate is formed).

Starch is tested for using a few drops of iodine. This causes the starch to turn blue-black.

Proteins are tested for using:

- Biuret test (food substance + dilute NaOH + CuSO_4): this produces a violet colour for a protein solution and a pink colour for peptone solutions.
- Millon's test (deep red colouration produced).
- Xanthoproteic reaction: Protein solution + few drops of conc HNO_3 . A white precipitate forms which turns yellow when heated). Cool + add few drops of NH_3 and the yellow colour turns orange.

38. D: The contractile vacuole of *paramecium* is different from the food vacuole! The contractile vacuole gets rid of excess water while the food vacuole digests engulfed food which is subsequently absorbed.

39. B: The primary host of a disease is the "definitive host"; the secondary host is the "intermediate host".

Man is the primary host of Bilharziasis (*Schistosomiasis*) a disease caused by blood flukes of the *Schistosoma* species. The water snail is the secondary (intermediate host) of the blood fluke.

One way to differentiate the primary host from the secondary host is that the adult forms of the parasite organism are found in the primary host (i.e. the form of the organism that is capable of reproducing). Also the parasite organism never reaches maturity (becomes an adult) in the secondary host!

40. **D:** Blood group **AB** is universal recipient (no antibodies) while blood group **O** is the universal donor (no antigen).