Combined Science for All Boards Additional Question Answers

Antibiotics, painkillers and new drugs

By extracting compounds from plants or microorganisms; By altering already existing compounds.

Selective breeding and genetic engineering

1 It is not always possible to get the functional allele into the cells; The allele may not be expressed by the cells.

2 GM bacteria – Produces human insulin; GM wheat – Drought resistance; GM sheep – Produces human blood clotting factors in milk.

3 **a** The human insulin gene is cut from human DNA using restriction enzymes; a plasmid is cut open using the same enzymes; the human insulin gene is inserted into the plasmid; the plasmid is placed inside the *E. coli* bacteria; the bacteria divide and make many copies of human insulin.

b The human body will not reject/react against human insulin; a large volume of insulin can be made; insulin can be made quickly; no ethical issues with using bacteria.

Abiotic and biotic factors

a The birds eat the insects that have been killed by DDT.

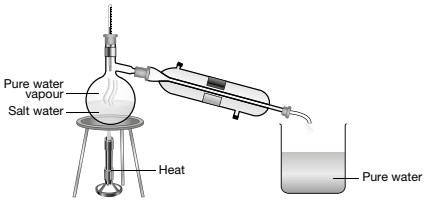
b The hawks are further up the food chain/top predators; DDT accumulates in the organisms as it moves up the food chain.

Biodiversity

Species can be protected in captivity; to build up the numbers of the population; The species can then be released back into their natural ecosystem.

Pure substances and formulations

a



b The salt water is heated; water boils at 100°C; the water vapour rises up the round-bottomed flask and enters a condenser where it cools and turns into a liquid; the salt is left behind as it boils at a higher temperature.

Limiting reactants

a $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

b 5.68 g

c The limiting reactant is oxygen; because in the balanced equation the ratio is 1:5 (0.3:1.5), but the engine only has 0.3:0.1; they could make the engine more efficient by increasing the amount of oxygen.

The electrolysis of aqueous solutions

1 **a** Copper chloride – copper and chlorine

b Potassium bromide – hydrogen and bromine

c Zinc sulfate – zinc and oxygen

d Sodium carbonate – hydrogen and oxygen

2 **a** $\mathbf{2}H^+ + \mathbf{2e}^- \rightarrow H_2$

b Chlorine; $2Cl^- \rightarrow Cl_2 + 2e^-$

3 **a** H^+/hydrogen; Li^+/lithium; OH^-/hydroxide.

b I^-/iodide ions attracted to anode/positive electrode; Lose electron/an electron; Form iodine; $2I^- \rightarrow I_2 + 2e^-$.

c Lithium hydroxide/LiOH

4 **a** Anode

b $4OH^- \rightarrow O_2 + 2H_2O + 4e^-$; OH^- and H_2O (correct; balanced)

National and global energy resources

Advantages: wind is renewable, doesn't emit greenhouse gases.

Disadvantages: wind is unreliable, requires a huge amount of land, is considered an eyesore.

Electrical charge and current

$$\text{Time} = \frac{\text{charge flow}}{\text{current}};$$
$$= \frac{1800}{6}$$
$$= 300 \text{ s; or } 5 \text{ minutes}$$

Current, resistance and potential difference and resistors

A2 = 0.5 A, A3 = 1 A, V2 = 5 V, V3 = 5 V

Series and parallel circuits

In a series circuit, current is the **same** throughout the circuit and **potential difference** splits across the components. In a parallel circuit, **potential difference** is the same across each branch of the circuit and current splits through the parallel branches. An ammeter must be connected in **series** to work correctly. A voltmeter must be connected in **parallel** to work correctly.

Hazards and uses of radioactive emissions

a 1 lead-210 for every 7 bismuth-210 means $\frac{1}{8}$th lead remains in sample

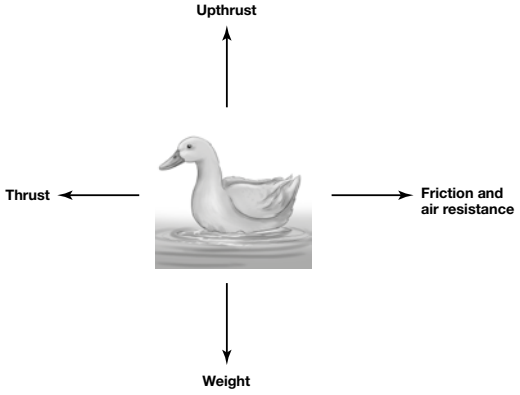
$1 \rightarrow \frac{1}{2} \rightarrow \frac{1}{4} \rightarrow \frac{1}{8}$

This means 3 half-lives have elapsed

b $3 \times 22 = 66$ years

Resultant forces

a Vertical and horizontal arrow pairs should be approximately the same size, if not subtract one mark from total; Friction and air resistance can be represented as two separate arrows.



b To accelerate there needs to be a resultant/unbalanced force; It is not possible for weight or upthrust to change; The duck needs to paddle faster to make the thrust force larger; The resultant force will now be greater than zero so the duck can accelerate.

Acceleration

a Acceleration

b Constant speed

c Deceleration

Newton's laws of motion

a Zero

b Resultant force = mass × acceleration

rearrangement:

$\text{acceleration} = \frac{\text{resultant force}}{\text{mass}}$

$\text{acceleration} = \frac{8000}{800}; = 10\,\text{m/s}^2$

c $\text{Acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$

rearrangement:

$\text{time taken} = \frac{\text{change in velocity}}{\text{acceleration}}$

$\text{time taken} = \frac{30}{10}; = 3\,\text{s}$

Properties of waves

$v = f \times \lambda$;

$\lambda = v/f; = \frac{300\,000\,000}{603\,000} = 497.5;$ m

Electromagnetic waves

a Long

b Short

c Low

d High

e Infrared

f Ultraviolet