

Practice Worksheet — Grade 12 Science

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Acid deposition

1. A 2.0 kg sample of water drawn from a rural well is analysed and found to contain 0.010 g of dissolved lead. What is the lead concentration, in parts per million?

Answer: _____ (ppm)

2. A coal-fired generating station releases the sulfur dioxide that drives acid deposition downwind. Which of the following measures would actually reduce the amount of acid-forming gas the station releases? Select all that apply.
- a) replacing part of the station's output with wind generation
 - b) burning coal that has a lower sulfur content
 - c) building a taller smokestack so the emissions disperse over a wider area
 - d) fitting flue gas scrubbers that remove sulfur dioxide before it leaves the stack
 - e) adding powdered limestone to lakes that have already turned acidic

3. A lake sample has a hydrogen ion concentration of 1.0×10^{-5} mol/L. What is its pH?

Answer: _____

4. What is the main cause of acid deposition?
- a) water vapour evaporating from the oceans and condensing over land
 - b) sulfur dioxide and nitrogen oxides released by burning fossil fuels
 - c) oxygen released by plants during photosynthesis in daylight hours
 - d) carbon dioxide breathed out by animals during ordinary respiration
5. How does acid deposition damage a lake ecosystem?
- a) it removes all water from the lake
 - b) it lowers the pH beyond what many organisms can tolerate
 - c) it increases dissolved oxygen to harmful levels
 - d) it raises the pH above 10

Blood defence and circulation

6. At rest a person's cardiac output is 5.0 L of blood per minute, and every 100 mL of arterial blood carries about 20 mL of oxygen. How much oxygen does the circulation deliver each minute, in litres?

Answer: _____ (L/min)

7. Blood pumped out of the heart travels through arteries, then arterioles, then capillaries, then venules and veins on the way back. Which statement correctly matches a type of vessel to its structure and its job?
- a) capillaries have the thickest, most muscular walls, and it is their squeezing that drives blood around the body
 - b) veins carry blood away from the heart and hold the highest pressure in the circulation
 - c) arteries have thin walls and one-way valves that stop blood from flowing backwards
 - d) capillaries have walls only one cell thick, so oxygen and nutrients can pass into the surrounding tissue

8. A heart beats 70 times per minute and pumps 70 mL with each beat. What is the cardiac output in litres per minute?

Answer: _____ (L/min)

9. Which blood component is mainly responsible for fighting infection?
- a) red blood cells
 - b) white blood cells
 - c) platelets
 - d) plasma proteins only

Energy efficiency

10. A rooftop solar array in Calgary has a total panel area of 20.0 m^2 and receives sunlight at 800 W/m^2 around midday. The panels convert 18% of the energy that lands on them into electrical energy. What electrical power does the array produce, in kilowatts?

Answer: _____ (kW)

11. A coal-fired generating station turns about 35% of the chemical energy in its fuel into electrical energy delivered to the grid. What becomes of the other 65%?
- a) it stays locked in the ash and can be recovered by burning the ash a second time
 - b) it is destroyed during combustion, since energy is used up when fuel burns
 - c) most of it leaves the station as waste heat, carried off by cooling water and exhaust gases
 - d) it is converted into extra chemical energy stored in the exhaust gases

12. A device takes in 150 J and delivers 45 J of useful output. What is its efficiency as a percentage?

Answer: _____ (%)

Energy sources and trade offs

13. What is the ultimate source of the energy stored in fossil fuels?
- a) heat from the Earth's core, which slowly cooked the buried material
 - b) the Moon's gravity, which compressed the sediments over millions of years
 - c) cosmic rays striking the ground and depositing their energy in the rock
 - d) sunlight captured by ancient organisms through photosynthesis
14. Which are alternative energy technologies? Select all that apply.
- a) nuclear fission reactors
 - b) solar photovoltaic panels
 - c) coal-fired power stations
 - d) tidal generators
15. What is a disadvantage of nuclear fission as an energy source?
- a) it can only operate during daylight
 - b) it produces radioactive waste that stays hazardous for a long time
 - c) it releases large amounts of carbon dioxide while generating
 - d) it produces very little energy per unit of fuel
16. Why is balancing energy demand against a viable biosphere difficult?
- a) energy use supports living standards but its by-products degrade the environment
 - b) the biosphere is largely unaffected by human activity at current scales
 - c) energy demand is falling everywhere, so the problem is solving itself
 - d) no technology exists that can generate useful energy without pollution

Induction and power transmission

17. A pole-mounted transformer steps the 7200 V carried on a distribution line down to the 240 V supplied to a house. Its primary coil has 3000 turns. How many turns does the secondary coil have?

Answer: _____ (turns)

18. A microwave oven and a dental X-ray machine both emit electromagnetic radiation, yet only the X-rays are described as ionising. What accounts for the difference?
- a) each X-ray photon carries enough energy to knock electrons free
 - b) microwaves are not part of the electromagnetic spectrum
 - c) microwaves have a shorter wavelength than X-rays
 - d) X-rays travel faster than microwaves do through empty space
19. A radio wave has a frequency of 1.0×10^8 Hz. What is its wavelength? Use $c = 3.00 \times 10^8$ m/s.

Answer: _____ (m)

20. What is induced when a conductor moves through a magnetic field?
- a) a magnetic field at right angles, but no voltage and no current
 - b) a current only, which flows whether or not the circuit is complete
 - c) a voltage, and a current if the circuit is complete
 - d) a static charge on the surface of the conductor, which then leaks away