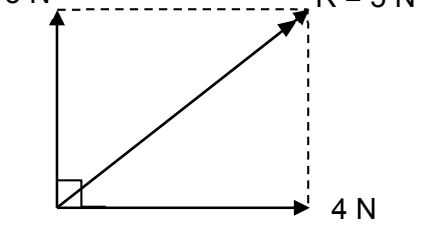
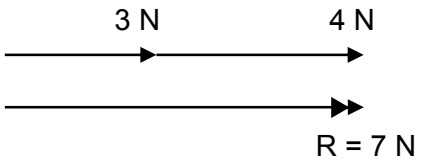
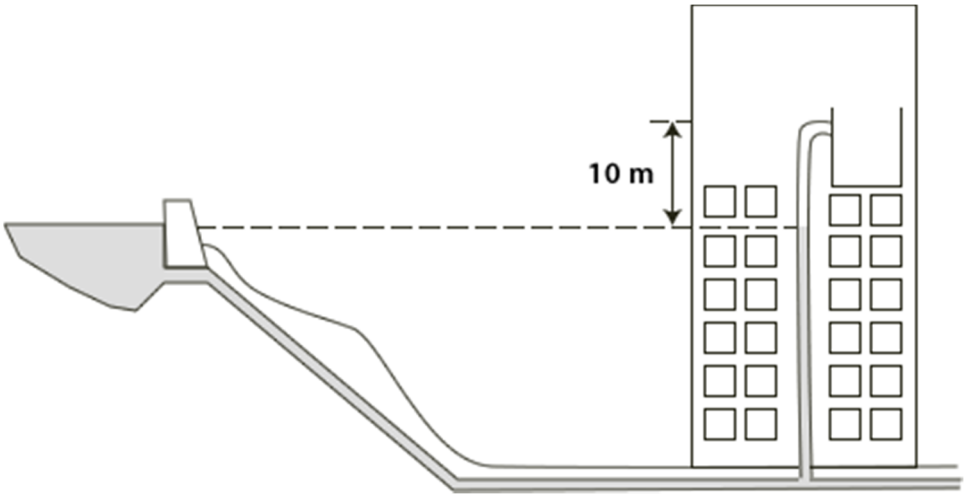
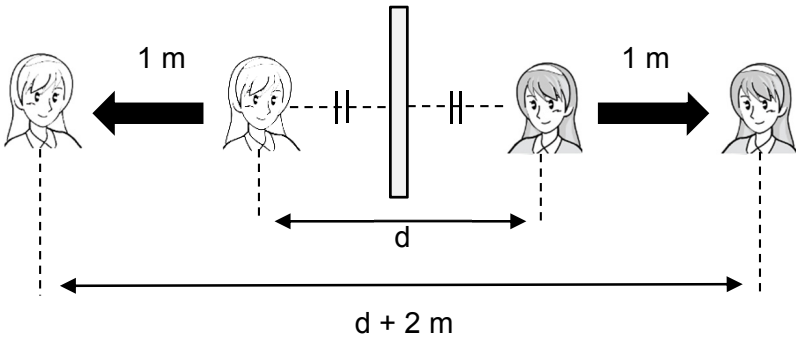
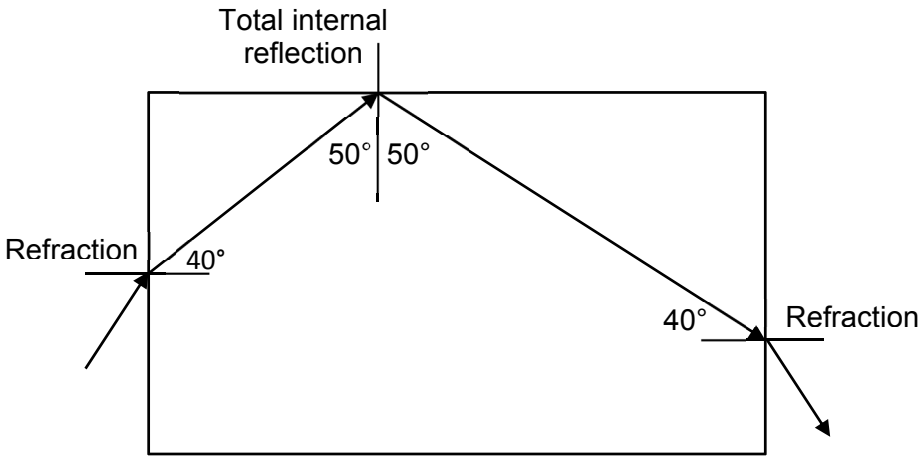
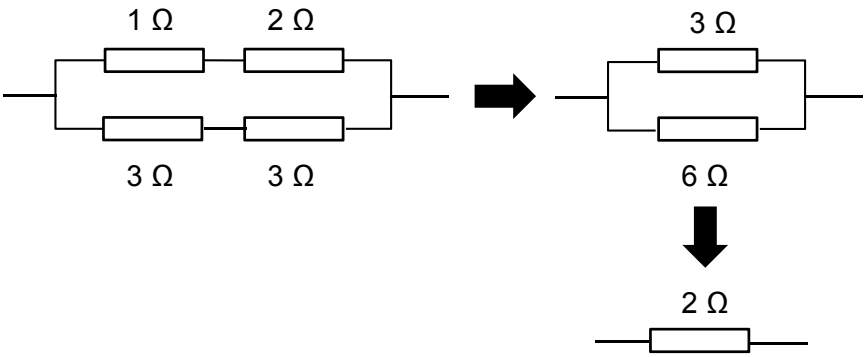
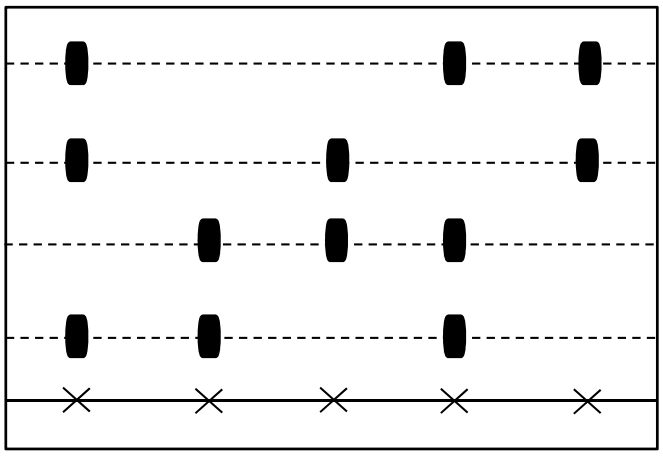
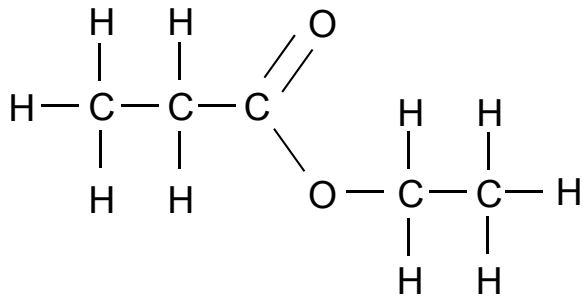
#	Ans	Workings/Remarks
PHYSICS		
1	B	The gradient of the speed-time graph gives the acceleration. From 0 to 5s: gradient is decreasing ⇒ acceleration is non-uniform From 5 to 10s: constant speed From 10 to 15s: gradient is constant ⇒ acceleration is uniform From 15 to 20s: at rest
2	A	Min value when angle = 90°  Max value when angle = 0°  5 N ≤ R ≤ 7 N
3	B	When the wooden block is traveling at **constant speed**, the resultant force acting on it is zero. Therefore the frictional force has to be equal and opposite to the pushing force.
4	C	The mass, m, of the astronaut does not change. Since the gravitational field strength, g, is lower on the Moon, his weight is lower (from F = mg).
5	D	$\text{Pressure} = \frac{\text{Force}}{\text{Area}} = \frac{1300}{0.03 \times 0.8} = 54 \text{ kPa}$
6	B	In order to lift the water into the tank, the pump needs to supply the energy determined by the difference in the water level (vertical) in the reservoir and the water tank.  **Water level if no pump is present** Since the difference in water level is 10m, the energy required to move 1 kg of water is mgh = 1 × 10 × 10 = 100 J. Therefore, the energy supplied by pump is 100 J.

7	A	Average Power $= \frac{432000000}{24\times60\times60} = 5000$ W
8	C	Fact
9	D	The boiling point of a substance is the temperature at which the liquid changes into a vapor. So, it can exist as both liquid and gas.
10	A	P & S indicate the wavelength. Q indicates the amplitude. R indicates the wavefront.
11	D	
12	C	
13	A	Since the shoal of fish is nearer to the boat than the seabed, we take the earlier echo at 0.5 s to indicate the position of the shoal of fish. Total distance travelled by the sound wave, = Speed × Time = 1500 × 0.5 = 750 m . Since, the position of the shoal of fish is at half the distance travelled by the sound wave, the distance below the boat is 375 m.
14	B	Like charges repel and the direction of the field lines is from positive to negative.

15	B	 $\text{Effective resistance} = \left(\frac{1}{3}+\frac{1}{6}\right)^{-1} = 2\ \Omega$
16	A	Since the current at P is made up of the currents at Q and R i.e. P = Q + R, P must be greater than Q.
17	C	$P = \frac{V^2}{R}$ When V is doubled, $P' = \frac{(2V)^2}{R} = \frac{4V^2}{R} = 4P$. Therefore, P is quadrupled.
18	D	Cost is dependent on energy consumption. Energy consumed by electric cooker = 5000 × 60 = 300 000 J Energy consumed by electric fire = 1000 × 60 × 10 = 600 000 J Energy consumed by electric iron = 500 × 60 × 60 = 1 800 000 J Energy consumption for lamp = 100 × 24 × 60 × 60 = 8 640 000 J Therefore, the lamp costs the most.
19	A	The most effective way is to insert the soft iron core into the solenoid using a d.c. source - not an a.c. source.
20	D	Using Fleming's Left Hand Rule, the direction of the force is to the right.

CHEMISTRY

21	B	 Spots that are in the same horizontal line are of the same dye. As such, from the diagram, since 4 horizontal lines of dyes are found across the 5 inks, 4 different dyes were used to make the five inks.

22	D	Note: question asks for which conclusion **must** be correct. The fact that the red litmus paper remains red suggests the gas evolved could be EITHER acidic OR neutral. A: Acidic gas was given off → may be correct. B: X is acidic → may be correct. C: X is magnesium → not correct. D: X is not ammonium chloride → definitely correct because if ammonium was present, ammonia gas would have been released, turning the litmus paper blue.
23	A	Particles arranged randomly at room temperature suggests the substance being in gaseous state at approximately 25 °C. Only option A is correct because the boiling point is lower than 25 °C.
24	C	The structure of the atom shown indicates 5 protons, 5 electrons and 7 neutrons. This suggests that it is from the Boron element, but with an extra neutron, making it an isotope of Boron. As such, the chemical symbol should be $^{12}_{5}\mathrm{B}$.
25	C	Only C is correct. An ionic compound is a poor conductor of electricity in solid state but a good conductor of electricity in molten and aqueous state.
26	D	 Total 17 bonding pairs of electrons
27	D	Overall equation between Magnesium and Hydrochloric Acid: $Mg\ (s) + 2HCl\ (aq) \rightarrow MgCl_2\ (aq) + H_2\ (g)$ $Mg\ (s) + 2H^+\ (aq) + 2Cl^-\ (aq) \rightarrow Mg^{2+}\ (aq) + 2Cl^-\ (aq) + H_2\ (g)$ Ionic equation, after cancelling out spectator ions: $Mg\ (s) + 2H^+\ (aq) \rightarrow Mg^{2+}\ (aq) + H_2\ (g)$
28	A	Number of moles of HC*l* reacted $= \frac{100\ \mathrm{cm^3}}{1000} \times 1\ \mathrm{mol/dm^3}$ = 0.1 mol Mole ratio of HC*l* : H_2, 2 : 1 ∴ Number of moles of H_2 formed = 0.05 mol Max volume of H_2 evolved = 0.05 × 24 dm^3 = 1.2 dm^3

29	B	Only B is correct as it is a fact that this process is endothermic. Options A, C and D are all exothermic reactions.
30	D	Only D is correct. A: Increasing the concentration of the reactant should **increase** and not decrease speed. B: Increasing the size of the pieces of solid should **decrease** and not increase speed. C: Increasing temperature increases the speed, but **not** because it increases the number of particles. It increases the kinetic energy of the particles.
31	A	Only A is correct. C gained oxygen to form CO. Oxidation occurs. B: Fe in Fe_2O_3 decreased from + 3 to 0 in Fe. Reduction, not oxidation occurs. C: CO was neither oxidised nor reduced. It is a product. D: Fe was neither oxidised nor reduced. It is a product.
32	B	Barium chloride is a **soluble salt** while Barium sulfate is an **insoluble salt**. Hence crystallisation needs to be done to obtain Barium chloride while Barium sulfate would need to be filtered.
33	A	Factual question on the trends down Group VII. Only option A is correct. B: Boiling point **increases** and not decreases with the increase in atomic size. C: Reactivity **decreases** and not increases. D: Density **increases** down the group because of the increasing atomic size.
34	C	From the ionic equations, the reactivity of the metals with respect to each other can be found. $Cu + X^+ \rightarrow$ no reaction $\Rightarrow$ Cu is less reactive than X $Fe + Cu^{2+} \rightarrow Fe^{2+} + Cu \Rightarrow$ Fe is more reactive than Cu $X + Zn^{2+} \rightarrow X^{2+} + Zn \Rightarrow$ X is more reactive than Zn $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu \Rightarrow$ Zn is more reactive than Cu $Zn + Fe^{2+} \rightarrow Zn^{2+} + Fe \Rightarrow$ Zn is more reactive than Fe $Zn + X^{2+} \rightarrow$ no reaction $\Rightarrow$ Zn is less reactive than X $\therefore$ In order of decreasing reactivity: X, Zn, Fe, Cu
35	A	Options B to D are reasons for recycling. For Option A, having less pure copper through recycling should be considered more as a disadvantage than a reason for recycling copper.
36	C	Factual question on air pollutants, sources and effects. Only C is correct. A: The effect of CO is its contribution to global warming. B: The source of CO is not lighting but the combustion of fossil fuels. D: The effect of SO_2 is not global warming but its contribution to acid rain.

37	A	Only A is correct. B: Physical properties change down the homologous series e.g. Boiling point increases as the number of C atoms increases. C: They are not members of different homologous series. They are all alkanes. D: They do not have different general formulae. All of the compounds have a general formula of C_nH_{2n+2}
38	D	Only D is correct. Vegetable oil is a polyunsaturated compound that undergoes catalytic hydrogenation to obtain Margarine. A: Butter (i.e. margarine) is polysaturated. B: Ethene only has one double bond. C: Poly(ethene) is saturated.
39	B	Only B is correct. A: Ethanoic acid is obtained by oxidation of ethanol with the use of oxidising agents or exposure in air (O_2) C: Ethanol is obtained by the hydration of ethene (addition of steam). D: Ethanol and Carbon dioxide is obtained by Fermentation of glucose.
40	D	The results of the two tests suggest that Z should have a **double bond** and a **carboxylic functional group**. Only option D fulfils this.