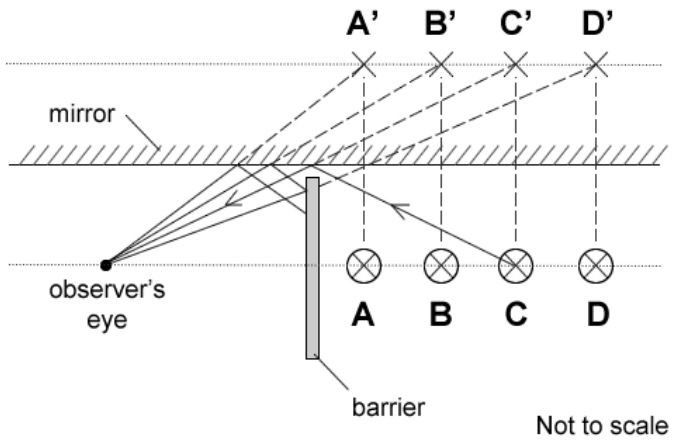
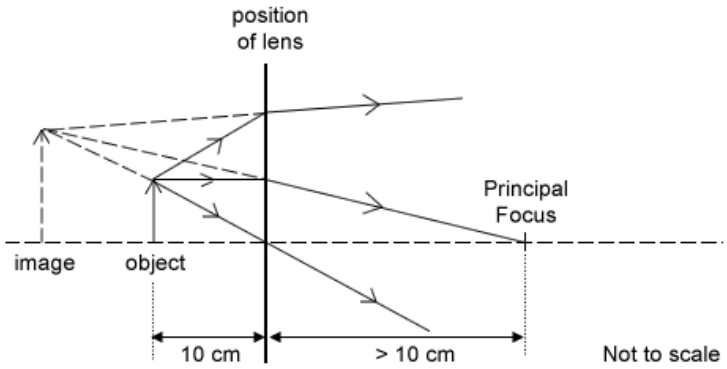
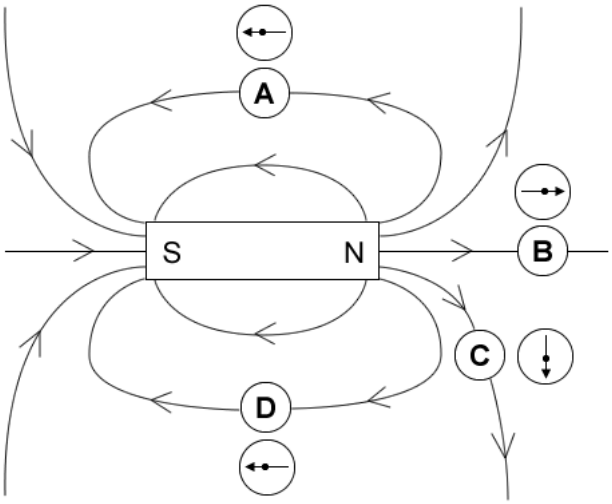
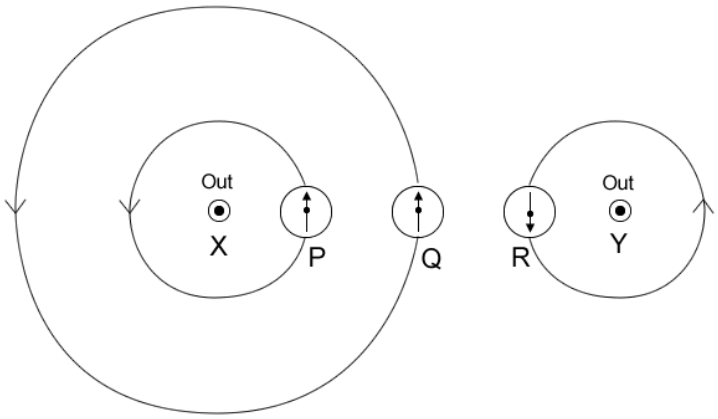
#	Ans	Workings/Remarks
1	D	Length of copper pipe of several metres long can be measured using either a rule or tape. External diameter of copper pipe can be measured using either a calipers or micrometer but internal diameter can only be measured with calipers. So only tape and calipers can be used.
2	D	Min resultant force: 4 – 3 = 1 N (opposite directions) Max resultant force: 4 + 3 = 7 N (same directions) 8 N is greater than the maximum possible resultant force so the magnitude cannot be 8 N.
3	C	At point A, the air resistance opposing the sky diver's motion begins to build up and so the net force downwards is reduced. He will still accelerate but at a lower rate until terminal velocity is reached (when the graph is horizontal at 40 m/s) while falling freely. At point B, the sky diver opens his parachute. The large surface area of the parachute gives rise to high air resistance acting upwards which is greater than the weight of the sky diver. The net force is upwards and he begins to decelerate rapidly within a short time duration (less than a second), hence the very steep negative gradient. At point C, the parachute has fully opened and air resistance provided by the fully-opened parachute enables the sky diver to rapidly reach his second terminal velocity at around 5 m/s in about 1-2 seconds, after which he spends the next 10 seconds 'cruising' downwards. At point D (about 1-2 seconds after point D to be precise), the sky diver lands on the ground and his speeds drops rapidly from about 5 m/s to 0.
4	C	Both objects have initial acceleration of 10 m/s^2. The one which is lighter will reach terminal velocity first while the one which is heavier will reach terminal velocity at a later time with a higher terminal velocity.
5	A	The submarine sinks with uniform speed and so its acceleration is 0 m/s^2. Since F = ma, the resultant force will be 0 N.
6	A	At the point of contact, the runner's shoe is moving backwards. To prevent this motion, the friction acts forward, in the opposite direction and provides the forward force that allows the runner to move forward.
7	B	The planet's gravitational field is experienced by any object near it and so the large rock will experience an attractive force on it, causing it to accelerate. This will cause the rock to change its direction of travel and increase its speed.
8	D	The three pieces of copper, P, Q and R are cut out from the same solid triangle and so the densities of all three of them are the same.
9	B	When a horizontal force P is applied on an object, friction F acts in the opposite direction. The weight W acts downwards due to gravity.
10	B	Taking moments about X Sum of clockwise moments = sum of anticlockwise moments Since the arm balances, the moment of C must be equal to the moment of P. The perpendicular distance between C and X is much shorter that that between P and X and so the weight of C must be greater than that of P.
11	C	$P_{water} = P_{cap}$ $h\rho g = \frac{F}{A}$ $0.30(1000)(10) = \frac{F}{4.0\times10^{-4}}$ $F = 1.2$ N

12	B	As pressure is directly proportional to height of column of liquid, any difference in the water level in the side arm and glass vessel would indicate a difference in pressure. As pressure is directly proportional to force, the difference in pressure would translate into a force which pushes the water level downwards in region of higher pressure (i.e. glass vessel) and upwards in region of lower pressure, till an equilibrium level is reached on both sides. Put it simply, zero difference in water level = zero difference in pressure = zero force = no further movement of water level. Hence, the pressure is the same at various points in the same horizontal level in a continuous stationary liquid and so when the levels have settled, they will come to rest at the same horizontal level.
13	D	$W = Fs = mg\left(\frac{h}{100}\right) = mgh/100$
14	B	$P = \frac{W}{t}$ $= \frac{Fs}{t}$ $= \frac{(300\ \text{N})(0.5\ \text{m})\times 10}{30\text{s}}$ $= 50\ \text{W}$
15	D	When a gas molecule hits the inner wall of a container, a force is exerted on the wall. At any time, there are many such collisions taking place between the gas molecules and the wall. The pressure exerted on the wall is the average force that is acting on the wall per unit area by these gas molecules.
16	C	When the tube is turned upside down with the open end facing down, the thread of mercury moves down slightly due to gravity. The volume of the trapped air increases and so the pressure is reduced.
17	B	Air is a poor conductor of heat and thus acts as an insulator of heat for the ice cream.
18	C	The voltmeter will register a reading only when there is a difference in the potential between the two junctions. When $T_1 = T_2$, there is no difference in potential and so no reading is registered on the voltmeter.
19	C	The term specific means "per unit mass" and so the difference between heat capacity and specific heat capacity is the mass involve.
20	A	The latent heat of vaporization is used to increase the average separation of the water molecules, changing liquid water into water vapour. Note that water is still water, regardless of it being in the liquid or gaseous state, hence the molecules are not split in the process.
21	B	A represents 2 × amplitudes B represents 1 × amplitude C represents ½ × wavelength D represent 1 × wavelength

22	C	
23	A	
24	D	All electromagnetic waves are transverse waves and travel at the speed of 3×10^8 m/s.
25	B	The speed of sound is constant. Since the frequency is high and $v = f\lambda$, it follows that the wavelength is smaller.
26	C	
27	A	Some of the negative charges on X will move through the metal rod to Y to neutralize some of the positive charges on it. This will cause both X and Y to be positively charged.
28	B	When voltage increases, 1/R (gradient of I-V graph) decreases and so resistance increases.

29	A	A diode is a semiconductor device that allows current to flow easily in one direction only, hence only half of the cycles appear. Since the diode only starts to conduct when there is a potential difference across it greater than 0.6 V, so only a maximum potential difference of 0.2 V is possible across the resistor.
30	D	Effective resistance of the parallel circuit (R_p): $\frac{1}{R_p} = \frac{1}{6.0} + \frac{1}{6.0}$ $R_p = 3.0\ \Omega$ For the overall circuit, $V = IR$ $6.0 = I(3.0 + R_p)$ $6.0 = I(3.0 + 3.0)$ $I = 1.0$ A
31	C	As current is constant in a series circuit, a larger p.d across a component indicates more work done.When temperature increases, the resistance of Y (a thermistor) decreases, resulting in an increase of the p.d. across the fan, making it go faster.
32	D	$E = Pt$ $= (3)(5) \times 4$ lamps $= 60$ J
33	B	Many electrical accidents occur in damp conditions, since water tends to provide a conducting path for current to flow. As the human body can only withstand a current of about 50 mA, a relatively small current is enough to pose a risk of electrocution.
34	A	
35	C	Using Fleming's left hand rule, the coil will rotate in ananti-clockwise direction about the axis PR.
36	D	Increasing the number of turns in the coil, increasing the strength of the magnet will increase the maximum value of the induced e.m.f. Raising the position of the coil will also increase the maximum e.m.f., as more magnetic flux gets 'cut' by the magnet that is now closer towards the coil. Only by raising the support of the spring will decrease the maximum value of the induced e.m.f, since less of the magnetic flux will be 'cut' in the process, as the speed and extent of the movement of the magnet remains unchanged.
37	A	The number of turns on the secondary coil is greater than that on the primary coil and so the output voltage increases. The number of turns has no effect on the periodic time.

38	C	Since the transformer is ideal, $P_s = P_p$ $P_s = I_pV_p$ $P_s = 1(6)$ $= 6$ W A: $P_s = 0.06$ W B: $P_s = 0.6$ W C: $P_s = 6$ W D: $P_s = 60$ W
39	A	When the brightness of the light shining on the LDR changes, the resistance will also changes. The resistance of the LDR and that of the fixed resistor will thus affect the output p.d. The input p.d. will also affect the output p.d.
40	C	Diagram 1: $T = \frac{1}{f}$ $= \frac{1}{50}$ $= 0.02$ s 1 complete wave is represented by 4 horizontal divisions, each division on the diagram $= \frac{0.02}{4}$ $= 0.005$ s Each vertical division = 2 V Diagram 2: $T = 2(0.005)$ $= 0.01$ s $f = \frac{1}{T}$ $= \frac{1}{0.01}$ $= 100$ Hz $V = 2V$