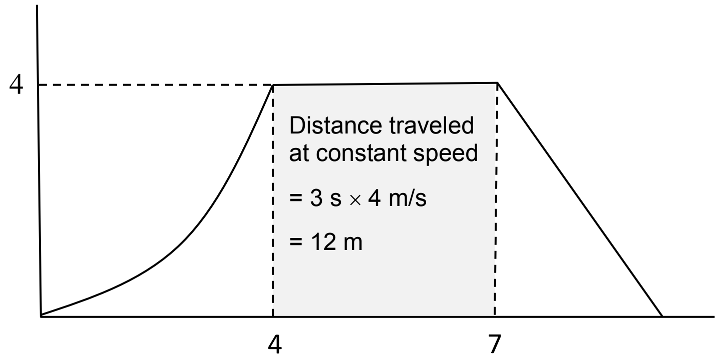
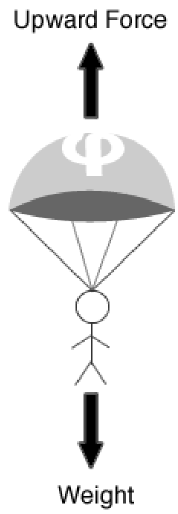
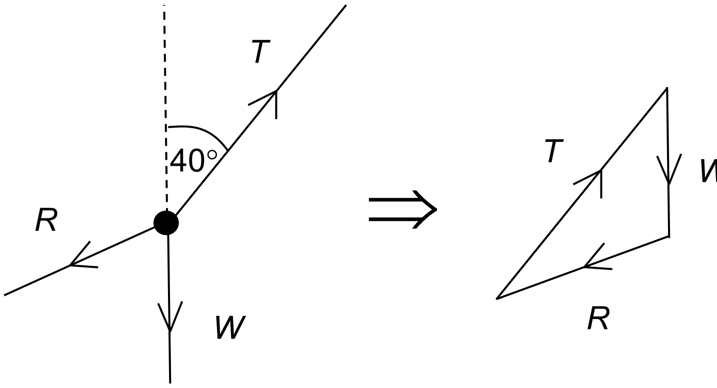
#	Ans	Workings/Remarks
1	C	Voltage = $\frac{\text{Work done}}{\text{charge}}$ The units work done (energy) is joules, J and charge is measured in coulomb, C.
2	C	-
3	B	From the graph, the time the car travels at constant speed is between 4 – 7 seconds.  The area of a speed-time graph gives the distance travelled by the car.
4	C	Since her total time taken is 2 hours, after taking a break of half an hour and spending a quarter of an hour in a traffic jam. Time left = 2 hours – 45mins = 1 hr 15 min which is 1.25 hrs Average Speed = $\frac{\text{Time distance}}{\text{time taken}}$ = $\frac{75 \text{ km}}{1.25 \text{ hrs}}$ = 60 km/h
5	B	At constant speed, there is zero acceleration and hence zero resultant force according to Newton's 2nd Law of F = ma Hence both the upward force on the parachutist must be **equal** to the weight of the parachutist so that there is no resultant force produced. 

6	A	Since the question specifies that the nail does not move, the diagram is in equilibrium This means that all three vector arrows must flow in a closed loop in order for the equilibrium situation to be maintained. 
7	A	If we let the mass of one brick be m and the volume of one brick be v, The density of the brick is given by Density $= \frac{\text{Mass}}{\text{Volume}} = \frac{m}{v}$ For the pile of bricks, Total mass = 3m Total volume = 3v $\therefore$ density of the pile of bricks $= \frac{3m}{3v} = \frac{m}{v}$ Hence the density remains the same but the mass and volume and mass are 3 times greater.
8	C	Considering the moments affecting rod N, Since the moments are balanced , and assuming R is 10g (there are 2 options with that) $\frac{Q\times 10\text{m/s}^2}{1000\text{g}} \times \frac{10\text{cm}}{100\text{cm}} = \frac{10\text{g}\times 10\text{m/s}^2}{1000\text{g}} \times \frac{20\text{cm}}{100\text{cm}}$ $\therefore Q = 20\text{g}$ Considering the moments affecting rod M, Total mass on the right hand end = 20g + 10g = 30g $\frac{30\text{g}\times 10\text{m/s}^2}{1000\text{g}} \times \frac{10\text{cm}}{100\text{cm}} = \frac{P\times 10\text{m/s}^2}{1000\text{g}} \times \frac{20\text{cm}}{100\text{cm}}$ $\therefore P = 15\text{g}$
9	C	Pressure $= \frac{\text{Force}}{\text{Area}}$ $\therefore$ Force = Pressure × Area $= 500 \times 10^3$ Pa $\times 0.2\text{m}^2$ = 100 000N

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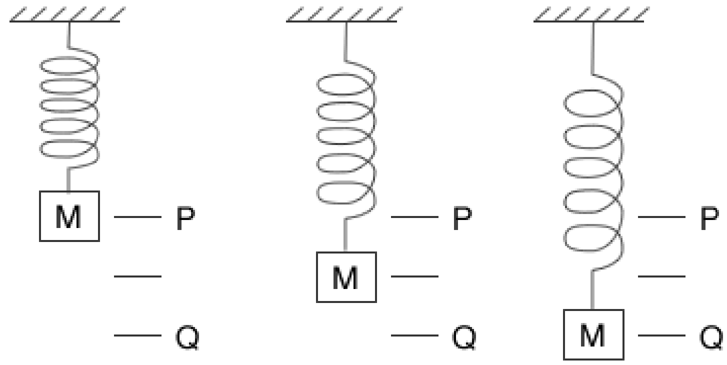
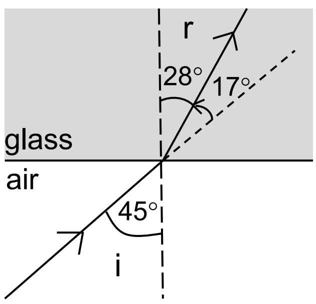
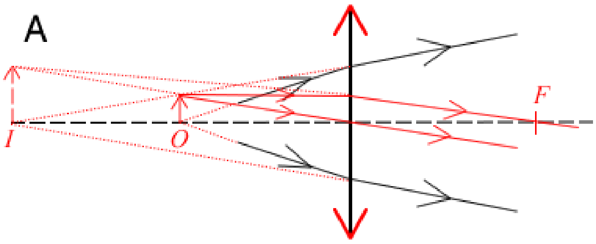
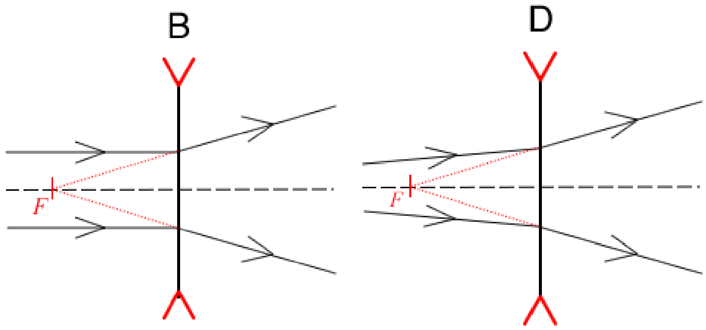
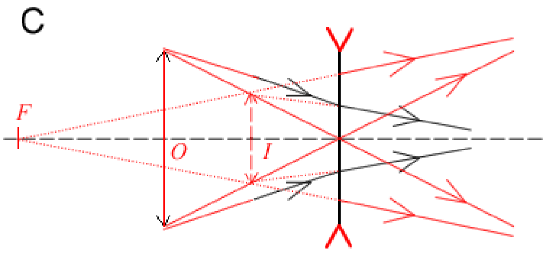
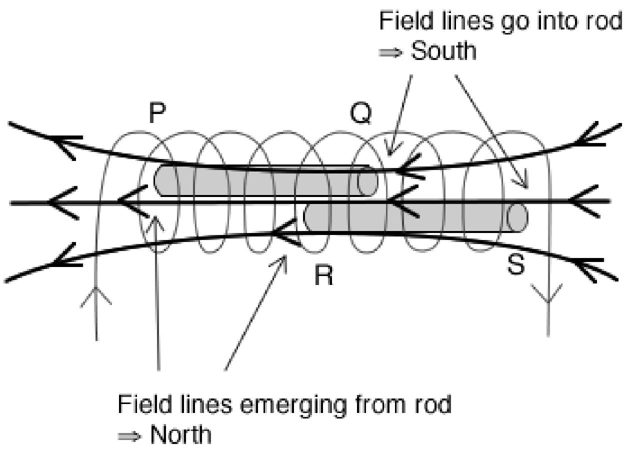
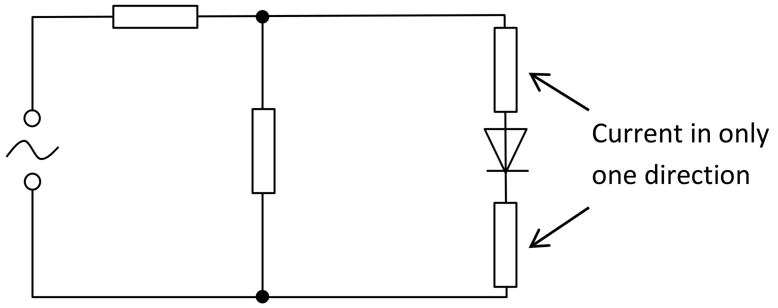
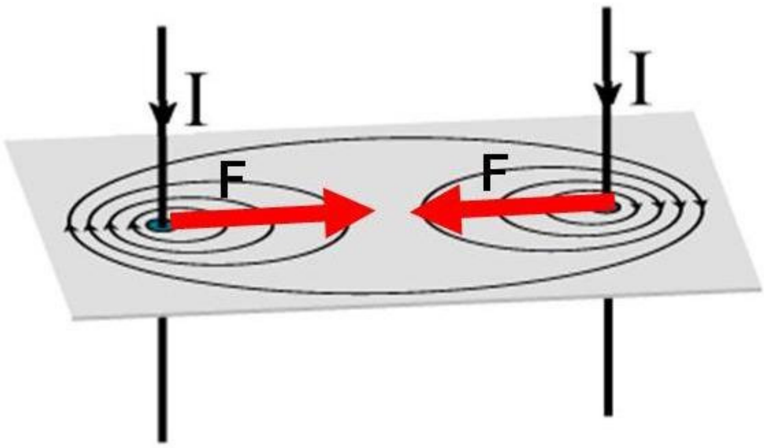
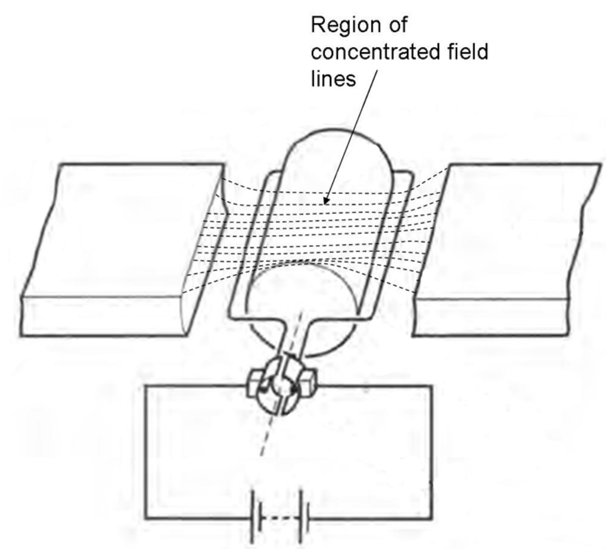
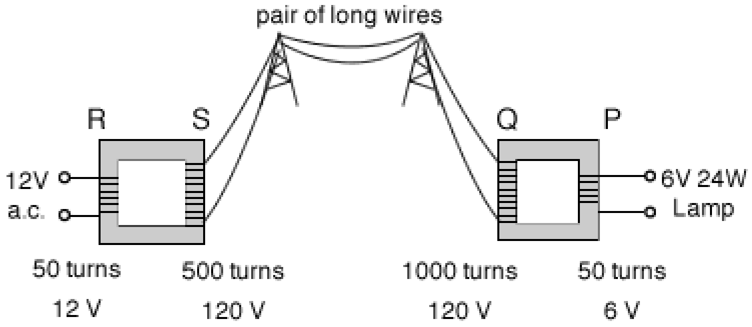
10	B	Pressure at P $= h\rho g$ $= 0.16\text{m} \times 1000\text{kg/m}^3 \times 10\text{m/s}^2$ $= 1600$ Pa Pressures at P & Q are the same by virtue of them being at the same height. Pressure at Q = Pressure at P $1600 = h\rho g$ $= 0.20\text{m} \times \rho_x \times 10\text{m/s}^2$ $\therefore \rho_x = 800\ \text{kg/m}^3$
11	D	 At highest point P, Total energy: - gravitational potential energy (mostly) - elastic potential energy At equilibrium position, Total energy: - kinetic energy (mostly) - gravitational potential energy (some) - elastic potential energy (some) At lowest point Q, Total energy: - elastic potential energy P is the highest point of the oscillation, that is where the mass stops, and does a U-turn ... if that's the case the mass cannot have kinetic energy at that point, instead it has gravitational POTENTIAL energy and some Elastic POTENTIAL energy (compression of spring) Q is the lowest point of oscillation, where the mass also stops and does another U-turn. Hence the mass has elastic POTENTIAL energy (stretched spring), and again, no kinetic energy. If Q is taken to be the datum, then also we do not have any gravitational potential energy
12	C	Work done = Force x Distance (in the direction of the force) 200 000J $= F \times 100$m $\therefore F = 2000$N
13	B	Power $= \dfrac{\text{Work done}}{\text{Time taken}}$ $= \dfrac{\text{Force} \times \text{distance(in the direction of the force)}}{\text{time taken}}$ Since the force, which is the weight of the student, is acting downward in the vertical direction, the HORIZONTAL distance of the stairs is not relevant to the calculation.
14	D	Self-explanatory

15	B	Since pressure is inversely proportional to volume (at constant temperature) for a fixed mass of gas, as the bubble rises it experiences lesser pressure on its ascent, and so its volume will grow larger.
16	C	Silver color affects the heat transfer of radiation only. Silver is a poor radiator and a good reflector of radiant heat. Conduction and Convection are reduced by the vacuum between he walls of the flask instead.
17	B	The largest e.m.f generated will correspond to the largest temperature difference between the junctions. Hence 80°C - 20°C = 60°C (largest)
18	A	Heat supplied by the heater = heat absorbed by the copper $Q = mc\Delta\theta$ $Pt = mc\Delta\theta$ $100\text{ W} \times 40\text{ s} = 2\text{kg} \times 400\text{ J/kg °C} \times \Delta\theta$ $\Delta\theta = 5\text{ °C}$
19	D	The specific latent heat of vapourisation occurs only during boiling. Mass of water boiled is 0.2kg. $Q = ml_v$ $Pt = ml_v$ $2000\text{ W} \times 5\text{min} \times 60\text{s} = 0.2\text{ kg } l_v$ $l_v = 3\ 000\ 000\text{ J / kg}$
20	A	Only energy can be transferred through the rope.
21	A	The angle of incidence is the angle bound between the normal and the incident ray, which is half of the angle of 80°.
22	C	$n = \frac{\sin i}{\sin r}$ $1.5 = \frac{\sin 45°}{\sin r}$ $\therefore r \approx 28.1°$ The question asks for the <u>change in the direction</u> of i when entering the glass, hence 45° − 28° = 17° 

23	A	A is a converging lens (magnification) as shown in the completed ray diagram below.  The rest are all diverging lenses as illustrated in the following completed ray diagrams.  
24	B	-
25	C	The greater the frequency, the greater the pitch. The greater the amplitude, the louder the sound.
26	B	
27	C	-
28	B	Unlike charges attract. Hence X and Y, and X and Z must have opposing charges.

29	A	$R = \frac{\rho L}{A}$ Rearranging, $L = \frac{RA}{\rho}$ for the first resistor. For the second resistor, $L_{new} = \frac{(2R)\left(\frac{A}{4}\right)}{\rho}$ $= \left(\frac{2}{4}\right)\frac{RA}{\rho}$ $= 0.5L$
30	B	As the current comes out from the alternating current supply, it can go through all four resistors if it travels in the clockwise direction, but when in the anti-clockwise direction the current cannot pass through the resistors which are along the same route as the diode.  Hence only 2 resistors carry the current in 2 directions, and the resistors adjacent to the diode carry current in ONE direction only.
31	D	Total Voltage of the circuit $= 2V + 2V$ $= 4V$ Total Resistance in the circuit (parallel) $= \frac{1}{\left(\text{sum of } \frac{1}{R}\right)}$ $= \frac{1}{\left(\frac{1}{2}+\frac{1}{2}\right)}$ $= 1\ \Omega$ Since $I = \frac{V}{R}$, Current in the circuit, A1 = A3 $= \frac{4V}{1\Omega}$ $= 4\ A$ A2 will have half the 4A current, i.e. 2A, as the 4A current branches out equally into the 2 identical resistors.
32	C	$P = \frac{V^2}{R} = \frac{(8V)^2}{12\ \Omega} = 5.3\ W$

33	B	• A person touches the earth wire: In normal working conditions, the earth wire carries no current, and also it is not connected directly to the live wire, hence it would not have any effect on the live wire. • A person touches the neutral wire: The person and the Neutral wire are both at zerovolt, hence with no potential difference current will not flow. • A person touches the live wire: The resistance of the human body ranges from a low end value of 500Ω. Normal household appliances have less resistance than that (kettle is typically 50Ω), hence the current drawn by the human body will be much less than that of appliances, and will not result in a blown fuse. • The live wire touches the neutral wire: With no resistance in between, this is as good as a short circuit, and infinite current will flow through the circuit, causing the fuse to blow. • The live wire touches the earth wire: If the live wire touches the earth wire directly, that would open current "floodgates", and infinite current flows to the ground.
34	D	 Wires that carry current in the same direction experience attractive forces
35	A	An iron core within the path of the magnetic field will concentrate field lines, making the motor more efficient. 

36	B	Induced emf is produced when a conductor (wire) experiences a rate of change of magnetic flux linkage (Faraday's Law).Hence, the wire will only have induced electromotive force if it experiences a changing magnetic field. At P and Q, the magnet stops momentarily before it changes direction. This means when stationary, it experiences no change in magnetic field, hence no induced e.m.f.
37	D	 $\frac{N_s}{N_p} = \frac{V_s}{V_p}$ $\frac{N_s}{N_p} = \frac{V_s}{V_p}$ $\frac{500}{50} = \frac{V_s}{12}$ $\frac{50}{1000} = \frac{V_s}{120}$ Output voltage at S = 120 V Output voltage at P = 6 V
38	D	The brightness of a lamp is determined by the current that flows through it. No matter how the LDR changes in resistance, L_1 has a fixed potential difference and is equal to the voltage of the battery. By Ohm's Law, the current flowing through L_1 is unchanged, hence its brightness stays the same. The potential difference across the series circuit of L_2 and the LDR is also fixed, but as the light intensity as increased, the LDR's resistance decreases leading to a higher current flowing through the LDR and L_2. Hence the brightness of L_2 increases.
39	A	Since potential difference is proportional to resistance for resistors in series, an increase in temperature leads to a decrease in the resistance of the thermistor, which leads to a decrease of potential difference across it. However all electrical components will somewhat have some resistance in the, and so it does not decrease to zero.
40	D	The screen displays two complete waveforms. Since frequency is the inverse of the period of the wave, and the period of the wave is the time taken for ONE wave, the period is $\frac{1}{400} \div 2 = \frac{1}{800}$ s. Hence the frequency is $\left(\frac{1}{800}\right)^{-1}$ which is 800 Hz.