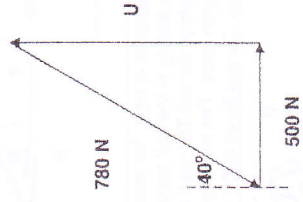


ANSWERS TO 2011 SNGS PHYSICS PRELIM

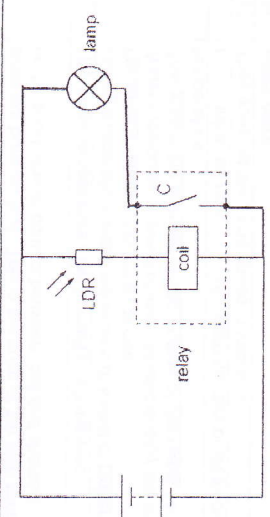
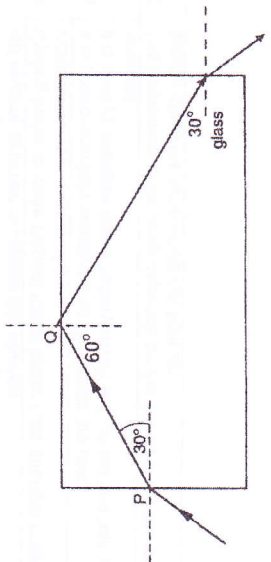
Paper 1

1	A	2	C	3	C	4	A	5	C	6	C	7	B	8	A	9	A	10	C
11	B	12	B	13	D	14	B	15	A	16	B	17	C	18	B	19	B	20	B
21	A	22	B	23	C	24	B	25	D	26	C	27	B	28	B	29	C	30	D
31	D	32	A	33	B	34	B	35	A	36	D	37	B	38	D	39	B	40	D

Paper 2

1a	(i) A (ii) D (iii) C
1b	Motion of rock: Constant velocity Explanation: The weight is balanced by the water resistance so no resultant force acts on rock. There is no acceleration.
1c	Water resistance is much greater than air resistance.
1d	Height of cliff is greater than depth of sea.
2	Scale: 1 cm reps 100 N Ans: U = (580 – 610 N) 
3a	$F = ma$ $T - 6000 = 600 \times 0.100$; $T = 6060 \text{ N}$
3b	Work done = $F \times d$ $= 6060 \times 11.3 = 68478 \text{ J}$ (or use $PE + KE$) $= 68500 \text{ J}$ (to 3 s.f.)
3c	Output power = $68478 / 15 = 4565 \text{ W}$ Power loss = Input power – output power = $6400 - 4565$ $= 1835 = 1800 \text{ W}$ (to 2 s.f.)
4a	Difference in air pressure = $100 - 60 = 40 \text{ kPa}$ $P = F/A$ $40000 = F / 0.0025$; $F = 100 \text{ N}$
4b	1. Pump out more air to reduce air pressure inside cup. 2. Increase the area of glass covered by the cup.
5a	When current passes through the coil, it becomes an electromagnet. The electromagnet attracts and pulls down the iron sphere. The net anticlockwise moment of the force of attraction on the iron sphere about the pivot causes end E of the barrier arm to move up.
5b	Barrier arm at end E will still be lifted up as coil will still be an

Marked

5c	electromagnet with alternating polarity. Taking moments about P, $1.4 \text{ W} = 0.1 \times 900$ $W = 64 \text{ N}$ (to 2 s.f.)
6a (i)	Resistance of LDR decreases.
6a (ii)	
6b (i)	$I = V/R = 12.0 / (2.5 \times 3) = 1.6 \text{ A}$
6b (ii)	$I = 1.6 \times 2 = 3.2 \text{ A}$ Fuse rating = 4 A or 5 A
6b (iii)	The fuse melts to break the circuit to protect the lamps from being damaged by excessive current.
6b (iv)	$E = VIt = (12.0 \times 3.2 / 1000) \times 4 \times 30 = 4608 \text{ kWh}$ Cost = $4608 \times \$0.25 = \1.15
7a	(i) Wavelength: 16.0 cm (ii) Frequency: $2/20 = 0.10 \text{ Hz}$ (iii) Speed: $v = f\lambda = 0.10 \times 16.0 = 1.6 \text{ cm/s}$ (iv) Amplitude: 4.0 cm C' is 4 cm directly above C.
7b	$\sin x / \sin 30 = 1.54$; $x = 50^\circ$ (to 2 s.f.)
8a	$\sin c = 1/1.54$; $c = 40.5^\circ$
8b	
8c	Use in optical fibres to transmit signals for telecommunications.

9a	Energy = power $\times$ time = $15 \text{ kW/m}^2 \times 7 \times 10^{-3} \text{ m}^2 \times 6.8 \text{ s} = 714 \text{ J}$ (to 2 s.f.)
9b	$Q = m c \Delta\theta$ $\Delta\theta = 714 / (0.040 \times 3500) = 5.1^\circ \text{C}$
9c	No. The temperature change in the foot is small and therefore firewalking does not burn his foot. This is because of the high specific heat of the foot or the short time of contact between foot and charcoal.
9d (i)	Higher air temperature / low humidity / strong wind
9d (ii)	During evaporation, water molecules of sweat of higher kinetic energy at the surface escape into the air above. Water molecules of sweat of lower kinetic energy are left behind. This lowers the average kinetic energy of the sweat hence lowering its temperature.
10a	(i) infra-red rays (ii) gamma rays or ultraviolet rays
10b (i)	They travel at the same speed in vacuum.
10b (ii)	water wave
10c (i)	Ultrasound is sound wave of frequency more than 20000 Hz.
10c (ii)	$1 / (6 \times 10^{-6}) = 1.7 \times 10^5$
10c (iii)	Not all sound is reflected from back surface as some passes through the back surface. Some energy/sound is absorbed by the metal.
10c (iv)	Sound/energy spreads out/scattered/reflected in other directions.

11	When the bicycle wheels turns, the permanent magnet turns and its magnetic field lines are cut by the coils. The changing magnetic flux linkages induce a current in the coils. As the magnet rotates, its poles exchange positions. The induced current will reverse direction to oppose this change.
11a (i)	Cycling faster to make magnet rotate faster / use stronger magnet / increase number of turns of coils.
11a (ii)	It is environmentally friendly as no chemicals are used. It is always available unlike battery which will run out and has to be replaced.
11a (iii)	The brightness of the lamp depends on the speed of the bicycle. When the bicycle stops the lamp would not light up.

11b	Purposes Of Main Electrical Components: A transformer to step down voltage. A diode to convert ac to dc.
11OR a (i)	
11a (ii)	When temperature is high, the resistance of the thermistor decreases. The current flowing in the coil increases. This increases the strength of the magnetic field of the coil. The reed switch is magnetised with unlike poles at the two open ends. The unlike poles attract each other and the reed switch closes. Current flows in the circuit so the warning lamp lights up.
11b (i)	
11b (ii)	The magnetic field of the permanent magnet and the magnetic field due to the current flowing in the coil combine to produce a resultant force on the coil. Side WX of the coil experiences an upward force while side YZ experiences a downward force (Fleming's Left Hand Rule). These forces produce a clockwise moment about the axis PQ so the coil rotates. The split-ring commutator reverses the direction of the current in the coil every half rotation of the coil so the coil can continue rotating in the clockwise direction.
11b (iii)	The rheostat can be used to vary the current flowing in the coil so the speed of rotation of the motor can be adjusted or controlled.