ANSWER SCHEME

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Section A [Minus 1 mark for whole paper for wrong significant figures]

1 Conceptually-correct scale diagram [M1]
Scale is at least 1 cm represent 20 N [B1]
Resultant force = 53-57 N [A1]
51-53^0 from the 70 N force [A1]

2(a) a = 10 m/s^2 [B1]

(b) 900 N [B1]

(c)(i) F = 1350 – 900
= 450 N [B1]
Up / upwards (Do not accept just an arrow pointing upwards) [B1]

(ii) F = ma
450 = 90 x a [Allow full ECF from (c)(i)] [C1]
a = 5.0 m/s^2 [A1]

3(a)(i) Mass per unit volume [B1]

(ii) Mass = 2400 x (15 x 2 x 0.25) [C1]
= 18 000 kg [A1]

(iii) Weight = 18000 x 10 [Allow ECF from (a)(ii)]
= 180 000 N [B1]

(b)(i) Pressure = 180 000 N / (15 x 0.25) [Allow ECF from (a)(iii)] [C1]
= 48 000 Pa [A1]

(ii) When the length of the wall is doubled, the weight/force is doubled along with contact area. [B1]

4 (a) Good insulator of heat or poor conductor of heat [B1]

(b) Radiation [B1]
Convection [B1]

(c) Colder air is denser so it sinks. [B1]
Hot air is less dense and it rises. Since the cold sink is lower, the sleeping area will not be too cold / is warmer. [B1]

5 (a) Speed = 15 m / 30 s = 0.50 m/s [B1]

(b) λ = v / f = 0.50 / 0.25 [Allow full ECF from (a)] [C1]
= 2.0 m [A1]

(c) By doubling the frequency, the wavelength is halved. [B1]

6(a) Enlarged/magnified/ larger/bigger than object & [B1]
Real/can be formed on a screen **(Do not accept not virtual)** [B1]

(b) 2 correct rays drawn with solid lines and arrows to tip of image. [B1]
2 correct rays drawn with solid lines and arrows to tip of image. [B1]
Deduct 1 mark if more than 2 arrows missing from the 4 rays

(c) 2 focal points correctly marked out with **F** on both sides of lens [B1]

(d) 15 cm [B1]

7(a) Some electrons from Perspex XY are transferred to the cloth during rubbing, hence Perspex XY becomes positively charged. [B1]

(b) As the Perspex is positively charged, negative charges are induced on top of the pieces of paper that are nearer to the Perspex / The paper is negatively charged [B1]
Since unlike charges attract, the paper thus move towards the Perspex by jumping up. [B1]

8(a) anticlockwise moments
= (720 x 2) + (100 x 0.5) [C1]

= 1490 Nm [A1]

(b) 1490 = F x 1 [C1]

F = 1490 N [A1]

(c) $\frac{1}{2} mv^2$ = 720 x 5 [C1]
v = 10 m s^{-1} [A1]

9(a) The lifeboat crew sees the flash first as light travels faster than sound. [B1]

(b)(i) Distance = 330 x 4.7 [C1]
= 1550 m (3 sig. fig.) [A1]

(ii) The time taken for the flash of light to travel to the lifeboat crew is negligible as the speed of light is very fast compared to that of sound. / The flash reached the lifeboat immediately. [B1]

Section B

10 (a) Current is the rate of flow of charge. [B1]

(b)(i) $1 / R_e$ = 1/ 6 + 1/6 + 1/6
R_e = 2.0 Ω [C1]

R_T = 2 + 4 = 6.0 Ω [A1]

(ii) V = IR
24 = I x 6 [Allow full ECF from (b)(i)] [C1]
I = 4.0 A [A1]

(iii) P.d. = 4 x 4 [Allow full ECF from (b)(ii)] [C1]

= 16 V [A1]

(iv) The lamp becomes dimmer. [B1]
The overall resistance of the circuit becomes larger when one of the 6 Ω resistors is removed, resulting in lesser current flowing in the lamp. [B1]

(v) Voltmeter drawn correctly on Fig. 10.1, parallel to the lamp. [B1]

11 (a) I = 200 W / 240 V [C1]
= 0.833 A [A1]

(b) 1.0 A fuse [Allow ECF from (a)] [B1]

(c) E = 0.2 kW x 36 h
= 7.2 kWh [C1]
Cost = 7.2 x 25 = $1.80 [A1]

(d) It needs to be placed at the bottom for heat transfer by convection to occur. [B1]
The water at the bottom gets heated, expands, becomes less dense and rises. [B1]
The water at the top, being cooler, is denser, sinks. This sets up a convection current and
cycle repeats itself and the whole water becomes heated eventually. [B1]

(e) It is a poor emitter/radiator of radiation and [B1]
heat from the water is retained longer / water loses heat at a slower rate [B1]

12 (a) Angle of incidence = 65°
Angle of refraction = 30°
Refractive index = sin 65° / sin 30° [C1]
= 1.81 [A1]

(b)(i) Critical angle = $\sin^{-1}(1/1.5)$ [C1]
= 41.3° [A1]

(ii) The angle of incidence is bigger than critical angle [B1]
and the light is travelling from an optically denser to less dense medium. [B1]

(iii) x = $\sin^{-1}(1.5 \times \sin 15°)$ [C1]
= 22.5° [A1]

(iv) If the bending is too much, this would make the angle of incidence smaller / less than the critical angle [B1]
and total internal reflection could not take place. [B1]