2014 Sec 4 End-Of-Year Examination
Physics Marking Scheme

Paper 1

Qn	1	2	3	4	5	6	7	8	9	10
Ans	**D**	**C**	**B**	**D**	**C**	**D**	**B**	**B**	**D**	**C**
Qn	11	12	13	14	15	16	17	18	19	20
Ans	**D**	**C**	**B**	**A**	**A**	**D**	**A**	**B**	**B**	**B**
Qn	21	22	23	24	25	26	27	28	29	30
Ans	**D**	**C**	**D**	**C**	**A**	**A**	**C**	**B**	**A**	**B**

Paper 2

Section A

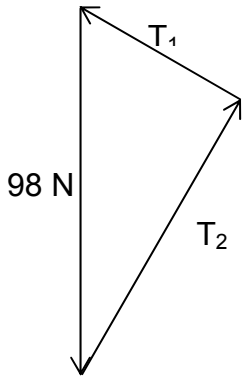
1 (a) upward is positive OR downward is negative

(b) It moves with constant negative acceleration until it hits the ground at 0.60 s it rebounds upward with velocity 6.0 m s^{-1} and decelerates uniformly to 0.0 m s^{-1} when it reaches the highest point at 1.20 s

(c) Total distance travelled = ½ (2.0 + 8.0) m s^{-1} × 0.6 s
= 3.0 m

(c) Displacement = ½ × 6.0 m s^{-1} × 0.6 s - 3.0 m
= -1.2 m or 1.2 m downwards

2 (a) appropriate scale e.g. (1.0 cm rep 20 N)
T_1 = 49 ± 2.0 N
T_2 = 85 ± 2.0 N



(b) Shift the two fixed pulleys M and N closer towards each other OR such that the cables are vertical

3 (a) Moment of a force about a point is the product of the force and the perpendicular distance of its **line of action**/the **line of action** of the force from the point. (no mark for "line of action" only, or use of other terms "force line", "line of force")

(b) Apply Principle of Moments about the pivot,
F (0.30 m) = 300 N (0.24 m)
F = 240 N

(c) The padding increases the contact surface and reduces the pressure on her legs

4 (a) time taken = 2 × 420 m / 1500 m s^{-1}
= 0.56 s

(b)(i) No, the water particles vibrate/oscillate in the same direction as/parallel to the direction of propagation of the ultrasound in water / travels as a longitudinal wave

(b)(ii) 10 ms

(c)(i) pressure due to water = (420 m × 1030 kg m^{-3} × 10 N kg^{-1})
pressure = 100 kPa + (420 m × 1030 kg m^{-3} × 10 N kg^{-1})
= 100 kPa + 4326 kPa
= 4400 kPa

(c)(ii) using (4426 kPa × 2.0 mm^3) = (100 kPa × v)
v = 88 mm^3

5 (a) Inverted F

(b) Image is real and inverted
Correct image and object distances with a clear scale
2 light rays (with arrows) from one point of the object converging on the corresponding point on the image

(c) Length must be correctly read off from earlier diagram. Answers from calculations are not accepted. Answers with no clear indication of how the answer was obtained from the diagram are not accepted. Focal length = 15.0 ± 5.0 cm

(d) the image will be dimmer / fainter / less bright / darker.

6 **(a)** $f = v/\lambda = 20 \text{ cm s}^{-1} / 10.0 \text{ cm}$
$= 2.0 \text{ Hz (2sf)}$

(b) $v = f\lambda$
$= 2.0 \text{ Hz} \times 6.3 \text{ cm} = 12.6 \text{ cm s}^{-1}$

7 **(a)** p.d. across X = 12.0 – 4.0 = 8.0 V
I = V/R = 4.0/3.0 = 1.33 A Hence, resistance of X = 8.0/1.33 = <u>6.0 Ω</u>

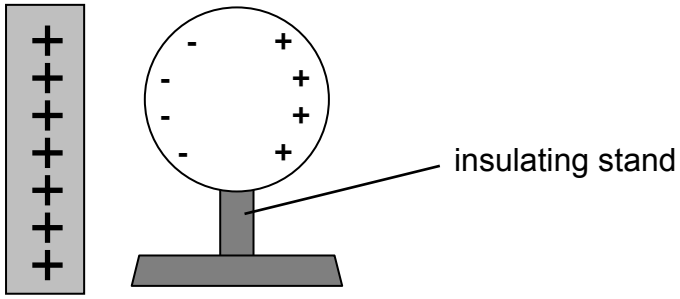
OR using <u>potential divider method</u>:
(X + 3)/3 = 12/4 or X/3 = (12-4)/4
X = 6.0 Ω

(b) Total current = (4.0/3.0 + 12.0/5.0) or (12.0/9.0 + 12.0/5.0)
= 3.73 ≈ <u>3.7 A</u>

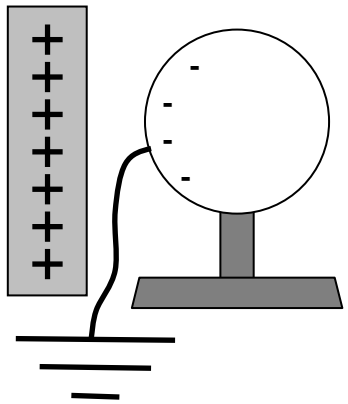
OR effective resistance: 1/R = 1/9.0 + 1/5.0, R = 3.214 Ω
Total current = V/R = 12.0/3.214 = 3.73 ≈ <u>3.7 A</u>

(c) When S is opened,
the <u>voltmeter reading</u> would <u>remain the same</u>
the <u>ammeter reading</u> would <u>decrease</u> (to 12/9 = 1.33 A)
(both must be correct)

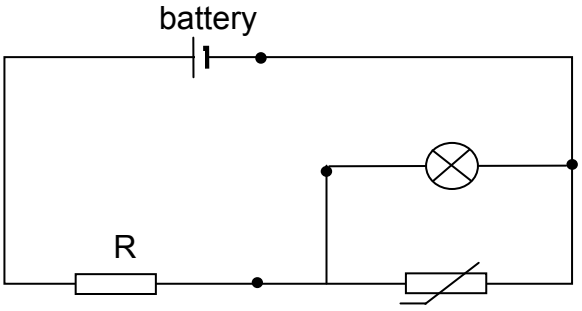
8 **(a)** <u>equal numbers of opposite charge</u> (-ve on left, +ve on right)



(b) <u>only negative charge remains on left side</u>



9 (a) correct symbol for thermistor
light bulb in parallel with thermistor



Section B

10 (a) (i) work done = mgh = (1500 + 460) N × 7.8 m
= 15288 ≈ 15 000 J

(ii) power = work/t = 15288 J / 4.0 s = 3800 W

(b) (i) The acceleration of the lift (and student) changes
(resultant force on the student changes)
The normal contact force on the scale changes
(exerted on the scale by the student)

(ii) N – mg = ma ➔ a = (N – mg) / m
where N is scale reading, m is mass of student
initial acceleration = (560 – 460) / 46
= 2.17 ≈ 2.2 m s^{-2}

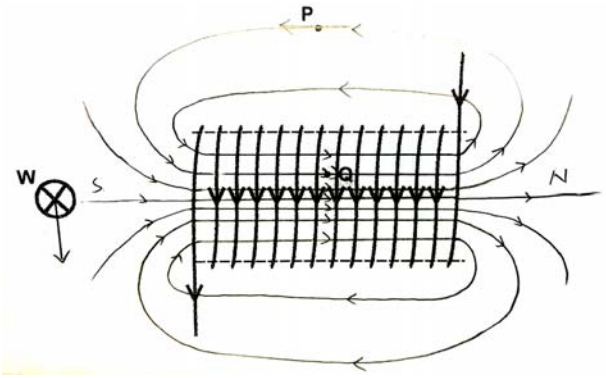
(iii) acceleration = (340 – 460) / 46
= - 2.61 ≈ - 2.6 m s^{-2}
deceleration of 2.6 m s^{-2}

(iv) the lift is falling freely
OR the lift accelerates downwards at 10 m s^{-2}

11 **(a)** hot water rises (**conduction** to take place) so that the water will heat uniformly.
(b) Q=mcΔθ
=80 x 4200 x (65-30)
= 11.8 MJ (3sf)
(c) t=E/P t=11.8 $x10^6$/1800
= 6530 s (1.81 hour / 1hr 49min)
(d) cost=units x cost per unit = (1.81hr x 1.8kW) x 22
= 72 cents
(e) add insulation / lagging – reduce heat flow by conduction
paint the colour white/silver – reduce heat flow by radiation
add lid – reduce heat flow by convection / evaporation
- for the **two** modifications
- **each** for mentioning method by which the rate of loss of heat is reduced

12 EITHER

(a) direction and shape of magnetic field inside the coil
direction and shape of magnetic field outside the coil
(ignore direction of field lines)



(b) To the left at P
To the right at Q

(c) correct direction of force on W (downwards)

(d) larger current through the coil / more turns of the coil / W closer to coil – any 2.

(e) N to the right and S pole to the left of the bar

(f) soft **iron** – magnetically soft can easily be **magnetised** & **demagnetised**

12 OR

(a) the coil of the wire cuts through the field lines of the magnetic field - continuously inducing an e.m.f. in the coil -
OR
As the coil rotates, the flux linkage of the coil with the magnetic field changes continuously thus inducing e.m.f.

(b) to allow the coil to rotate continuously in the same direction

(c) **(i)** current marked in correct direction (clockwise around coil)
(ii) force marked in correct direction (Down on left, Up on right)

(d) Bulb removed gives open circuit so no current flows around circuit. Thus there will be no force in the wires.

(e) more turns in coil - greater e.m.f. generated / more current -
stronger magnet - cuts through more field lines -
rotate coil faster speed - cuts through more field lines per unit time -
(any 2 of the above)

(f) Sine wave drawn with **Amplitude 3 squares** and **period of 8 squares** .

End of paper