1) Application of work energy theorem or $v^2 = u^2 + 2ax$ etc (0.5 mark)
The final velocity = $\sqrt{(2000)}$ = 44.72 m/s (0.5 Marks)

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2) Realization that the fields due to the horizontal and vertical wires are in opposite direction only in the 1st and 3rd quadrant (1.2 Marks)

Correct equation , x=y (0.8 marks)

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3) The spring stretches till the restoration force equals weight (0.3 marks)
Mg =kx (0.3 marks)
x=.1 m (0.4 marks)
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4) The height does not change and thus the answer is 6.6cm (1 Mark , NO partial credits)

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5) Heat used for heating the gas = 50% of 1000J = 500J (0.4 Marks)

The temperature increase thus = 500/ Cv = 500/(3R/2) = 1000/(3R) (0.6 Marks)

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6) Realization of angular momentum conservation (1 Mark)
Use of $L = I\omega$ (0.5) => $\omega' = (I/I')\,\omega$ (0.6 Marks)
So $\omega' = (R'/R)^2\,\omega$ (0.6 Marks)
Numerical result = 4 revs/day (0.8 Marks)
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7) $dS = dQ/T$ (0.5 marks)
In this process, pressure is constant (0.5 marks)
So, ΔS = integral of $C_p\,dT / T$ (0.5 Marks)

Answer , $\Delta S = C_p \ln(3)$ or $2.5\,R \ln(3)$ (0.5 marks)

8) Application of superposition principle (1 mark)
Realization that all charges effect is the same as placing a –q charge at the same place at the empty vertex (1.2 Marks)
So, $F = (1/4\pi\varepsilon_0)\, qQ/r^2$ (0.8 marks)

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9) The E vs r curve must be labeled (0.4 marks)
E curve must pass through the origin (0.2 Marks)
E must have its maximum at r=R (0.4 marks)
E field inside the sphere must be linear in r i.e. a straight line (0.5 marks)
Outside field must fall off as inverse of the distance or rapidly (0.5 Marks)

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10) The amplitude is doubled (0.5 marks)
The intensity is square of the amplitude and hence it increases by a factor of 4 (0.5 marks)

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11) 3R (1 Mark) (NO partial marks)

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12) In the first polarizer the unpolarized light has its intensity halved (1 mark)
In each subsequent polarizer the intensity reduces by $(\cos 1^0)^2$. (0.5 marks)
The final intensity is thus reduced by a factor of 0.5 $(\cos 1^0)^{180}$ (0.5 marks)