**CW 13.8 – Clouds Name: ……………………………………**



A thundercloud has the charge distribution illustrated above left. Treat this distribution as two point charges, a negative charge of –30 C at a height of 2.0 km above ground and a positive charge of +30 C at a height of 3.0 km. The presence of these charges induces charges on the ground. Assuming the ground is a conductor, it can be shown that the induced charges can be treated as a charge of +30 C at a depth of 2 km below ground and a charge of –30 C at a depth of 3 km, as shown above right. Consider point P1, which is just above the ground directly below the thundercloud, and point P2, which is 1 km horizontally away from P1.

1. Determine the direction and magnitude of the electric field at point P1. (3)
2. i) On the diagram, clearly indicate the direction of the electric field at point P2­ (1)

ii) How does the magnitude of the field at this point compare with the magnitude at point P1? Justify your answer: (2)

\_\_\_\_ Greater \_\_\_\_Equal \_\_\_\_ Less

1. Letting the zero of potential be at infinity, determine the potential at these points. (4)
2. Point P1
3. Point P2

1. Determine the electric potential at an altitude of 1 km directly above point P1. (2)
2. Determine the total electric potential energy of this arrangement of charges. (2)