4 (a) Define *capacitance*.

....

....[1]

(b) An isolated metal sphere has a radius *r*. When charged to a potential *V*, the charge on the sphere is *q*.
The charge may be considered to act as a point charge at the centre of the sphere.

(i) State an expression, in terms of *r* and *q*, for the potential *V* of the sphere.

....[1]

(ii) This isolated sphere has capacitance. Use your answers in **(a)** and **(b)(i)** to show that the capacitance of the sphere is proportional to its radius.

[1]

(c) The sphere in **(b)** has a capacitance of 6.8 pF and is charged to a potential of 220 V.

Calculate

(i) the radius of the sphere,

radius = ... m [3]

(ii) the charge, in coulomb, on the sphere.

charge = ... C [1]

(d) A second uncharged metal sphere is brought up to the sphere in **(c)** so that they touch. The combined capacitance of the two spheres is 18 pF.

Calculate

(i) the potential of the two spheres,

potential = ... V [1]

(ii) the change in the total energy stored on the spheres when they touch.

change = ... J [3]