Q- An object is 14.4 cm in front of a converging lens that has a focal length equal to 14.3 cm. A diverging lens that has a focal length whose magnitude is equal to 1.2 cm is located 20.0 cm in back of the first.

(a) Find the location of the final image and describe its properties.

For the first lens, object distance u = - 14.4 cm and focal length f = 14.3 cm

Hence the location of the image by the first lens is given by using lens formula

$$\frac{1}{v} - \frac{1}{-14.4} = \frac{1}{14.3}$$

Or $$\frac{1}{v} = -\frac{1}{14.4} + \frac{1}{14.3} = \frac{-14.3+14.4}{14.4*14.3} = \frac{0.1}{205.92}$$

Gives v = 205.92/0.1 =2059.2 cm

This image due to first lens will behave as virtual object for the second lens and hence for the second lens u = 2059.2 – 20 = 2039.2 cm and f = - 1.2 cm

Using lens formula for the final image we have

$$\frac{1}{v_f} - \frac{1}{2039.2} = -\frac{1}{1.2}$$

Or $$\frac{1}{v_f} = \frac{1}{2039.2} - \frac{1}{1.2} = \frac{1.2-2039.2}{2039.2-1.2} = \frac{-2038}{2447.0}$$

Gives v_f = - 2447.0/2038 = - 1.2007 cm

Hence the final image is 1.2 cm right to the second lens.
The final image distance is negative means that the image is erect and virtual.

(b) Draw a ray diagram to corroborate your answers to part (a).