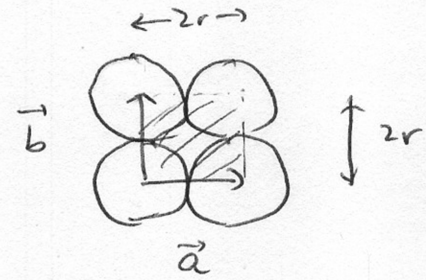
HW I ; solution.

1A. (a)

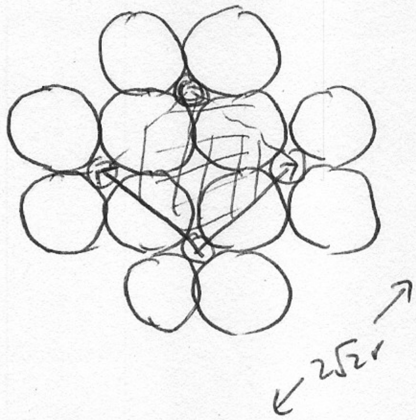


(b) area $= (2r)^2 = 4r^2$

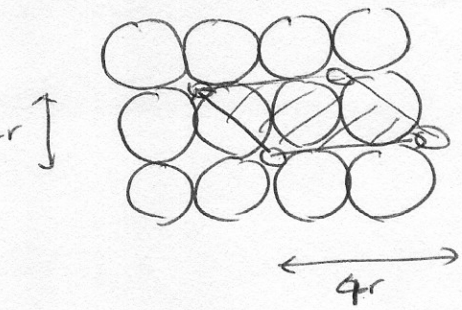
(c) one

B

(a)



other choices also possible : eg.



(b) area $= (2\sqrt{2}r)^2 =$

$= 8r^2$

area $= 8r^2$

(indep. of choice of unit cell)

(c) two large.
one small

(e) radius $= (2\sqrt{2}r - 2r)/2$

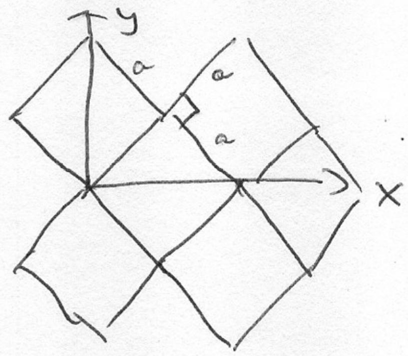
$= (\sqrt{2}-1)r$

2 $\quad \varepsilon_{xx} = \varepsilon_{yy}$ yes

$\varepsilon_{xy} = 0 = \varepsilon_{yx}$ yes

Pf : ~~many~~ many ways.

method (i)



notice one has reflection symmetry

$x \leftrightarrow -x \quad y \leftrightarrow y$ [or $x \to x,\ y \to -y$]

Then $\varepsilon_{xy} = \varepsilon_{yx} = 0$

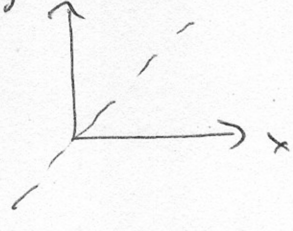
[e.g. consider $D_x = \varepsilon_{xx} E_x + \varepsilon_{xy} E_y$

$(-D_x) = \varepsilon_{xx}(-E_x) + \varepsilon_{xy} E_y$

these equations are consistently only if $\varepsilon_{xy} = 0$

notice also one has reflection symmetry along diagonal:

$x \leftrightarrow y$

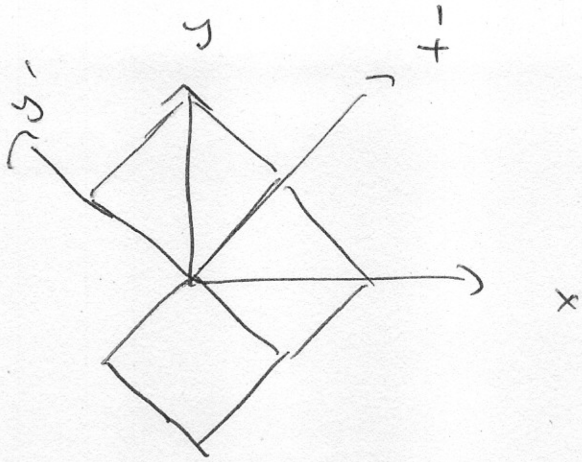


$D_{\cancel{x}} = \varepsilon_{xx} E_x$

$D_y = \varepsilon_{xx} E_y$

but by definition of ε_{yy} : $D_y = \varepsilon_{yy} E_y$

$\therefore \quad \varepsilon_{xx} = \varepsilon_{yy}$ for consistency method (ii)



notice that the crystal in x' y' axis is just the ordinary square lattice.

There we know (class) $\Sigma_{x'x'} = \Sigma_{y'y'}$ $\Sigma_{x'y'} = \Sigma_{y'x'} = 0$

rotational transformation gives $\Sigma_{xx} = \Sigma_{yy}$ $\Sigma_{xy} = \Sigma_{yx} = 0$
(by $\pi/4$)†

* There are still many more ways, too lengthy to write all of them!!

$\dagger$ note: rotation by $\pi/4$ itself is <u>NOT</u> a symmetry operation