Advanced Physical Chemistry II

HW Part III

王石嵘

161240065

January 11, 2020

29 Solids and Surface Chemistry

1,2,3,5,9,13,14,15,16,18,21,24,
25,27,29,37,38,43,46,51,53,54,55,
57,58,61,65,68

29-1

$$\rho = \frac{m}{V} = \frac{M}{a^3 N_\mathrm{A}} = \frac{209\,\mathrm{g/mol}}{(334.7\times10^{-10}\,\mathrm{cm})^3 \times N_\mathrm{A}} = 9.26\,\mathrm{g/cm^3} \tag{29.1}$$

29-2

a) Primitive cubic:
$a = 2R$ is obvious.

$$f = \frac{\frac{4}{3}\pi R^3}{(2R)^3} = \frac{\pi}{6} \tag{29.2}$$

b) Face-centered cubic:

$$4R = \sqrt{2}a \Rightarrow a = \frac{4R}{\sqrt{2}} \tag{29.3}$$

$$f = \frac{4\times\frac{4}{3}\pi R^3}{\left(\frac{4R}{\sqrt{2}}\right)^3} = \frac{16\pi/3}{32/\sqrt{2}} = \frac{\sqrt{2}\pi}{6} \tag{29.4}$$

b) Body-centered cubic:

$$4R = \sqrt{3}a \Rightarrow a = \frac{4R}{\sqrt{3}} \tag{29.5}$$

$$f = \frac{2\times\frac{4}{3}\pi R^3}{\left(\frac{4R}{\sqrt{3}}\right)^3} = \frac{8\pi/3}{64/3\sqrt{3}} = \frac{\sqrt{3}\pi}{8} \tag{29.6}$$

29-3

$$r = \frac{\sqrt{3}a}{4} = 143.0\,\mathrm{pm} \tag{29.7}$$

29-5

$$a = \frac{4r}{\sqrt{2}} = 361.5\,\mathrm{pm} \tag{29.8}$$

$$\rho = \frac{NM}{a^3 N_\mathrm{A}} = \frac{4 \times 63.55\,\mathrm{g/mol}}{(361.5 \times 10^{-10}\,\mathrm{cm})^3 \times N_\mathrm{A}} = 8.94\,\mathrm{g/cm^3} \tag{29.9}$$

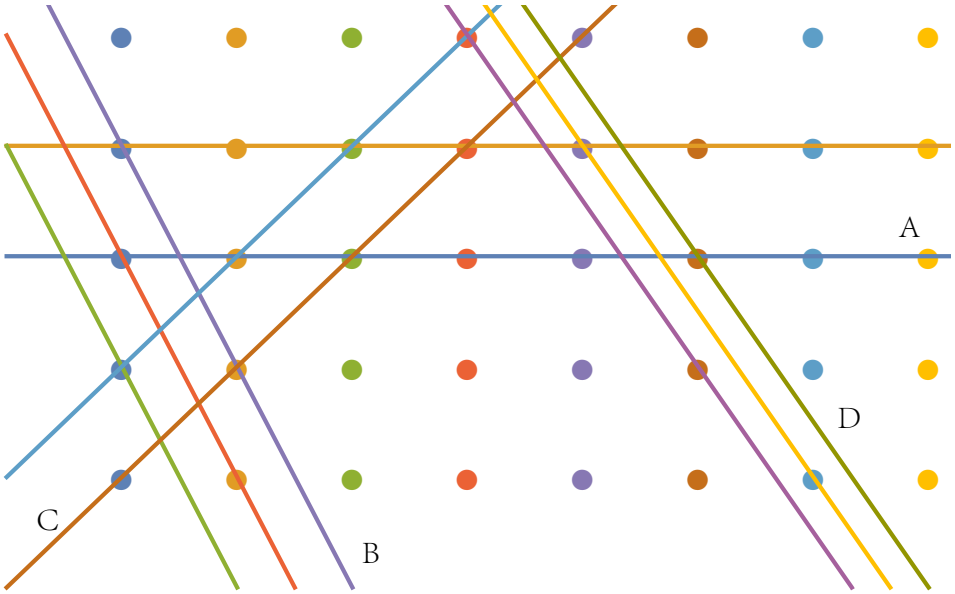
29-9

$$N = \frac{\rho a^3 N_\mathrm{A}}{M} = \frac{2.75 \times (654 \times 10^{-10})^3 \times 6.022 \times 10^{23}}{119.0} = 3.9 \tag{29.10}$$

thus there's 4 formula units of KBr in a unit cell.
The unit cell has a NaCl structure.

29-13
A: $1\bar{3}$
B: 11
C: 01
D: 32

29-14



29-15 They are perpendicular to each other

29-16 They are equivalent.

29-18
A: 111
B: 110
C: 54 10
D: $22\bar{4}$

29-21

$$d = \frac{a}{\sqrt{h^2 + k^2 + l^2}} \tag{29.11}$$

thus

$$d(100) = \frac{529.8}{1} = 529.8\,\mathrm{pm} \tag{29.12}$$

$$d(111) = \frac{529.8}{\sqrt{3}} = 305.9\,\mathrm{pm} \tag{29.13}$$

$$d(12\bar{1}) = \frac{529.8}{\sqrt{6}} = 216.3\,\mathrm{pm} \tag{29.14}$$

(29.15)

29-24

29-25

29-27

29-29 37,38,43,46,51,53,54,55, 57,58,61,65,68