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① circled

Exam 2

-7, 18/25

-4, thermal expansion in fuel and cladding causing gap change,
fission causing rapid T increase

1- Question 1

① Cladding : cladding temperature rise to about 650 K

gap : constant no change 40 μm

pellet : Temperature rise (center) / Surface pellet temperature rise
(≈ 1300 K)   to ≈ 800 k

② Cladding : temperature constant ≈ 650 k

gap : small expansion to 55 μm, no considerable change (from 40 to 55 μm)

Pellet { fuel center temperature rise above 1300 k
        surface temperature at ≈ 800 k
        densification may to took place.

-1, Densification definitely took place

③ Cladding : temperature constant ≈ 650 k

gap : Reduce from 55 μm to ≈ 40 μm due to pellets expansion!

Pellet { center : temperature slow decrease but still around 1250k
        surface : temperature decrease from 800 k to 760 k

④ Cladding : temperature constant to 650 K

gap : Considerable decrease about 5 μm due to pellet
      g. expansion and fission products release.

pellet { center : small bump in temperature but remain around
                  1300 K
        surface : temperature decrease around 700k as
        burnup continue and the release of fission product
        with fuel expansion continue to take place.

Question 1

⑤

Cladding: temperature constant ≈ 650 K (Pellet-Clad Interaction)

gap: decreased to 0 ~~mm~~ ~~in contact~~
(PCI): Pellet-Clad interaction

pellet {
Center: temperature increased to about 1350 K

Surface: temperature around 700 K.

Pellet expansion, ~~come~~ in contact with Clad.

-2, T increase due to decrease in fuel k with burnup

Question 2

-27, 3/30

a.) fission gas diffusion coefficient

~~for~~

$$\cancel{\phi} = 2.0 e^{13} \times 8 10^{-4} = 16 \times 10^9 \text{ fission/cm}^2$$

-5, D = 8.94e-17 cm2/s

b.) $0.317 \times 2.0 e^{13} \times 365 \times 2 = 462.82 \times 10^{13}$ gas atom/cm³

-8, = 7.56e+19 gas atoms/cm3

c) $N_{FG} = Y \dot{F} =$

$= 0.10 \times 2.0 e^{13} \times 0.317 \times 730$

$= 46.3 \times 10^{13}$ gas atom/cm³

-14, time? f?
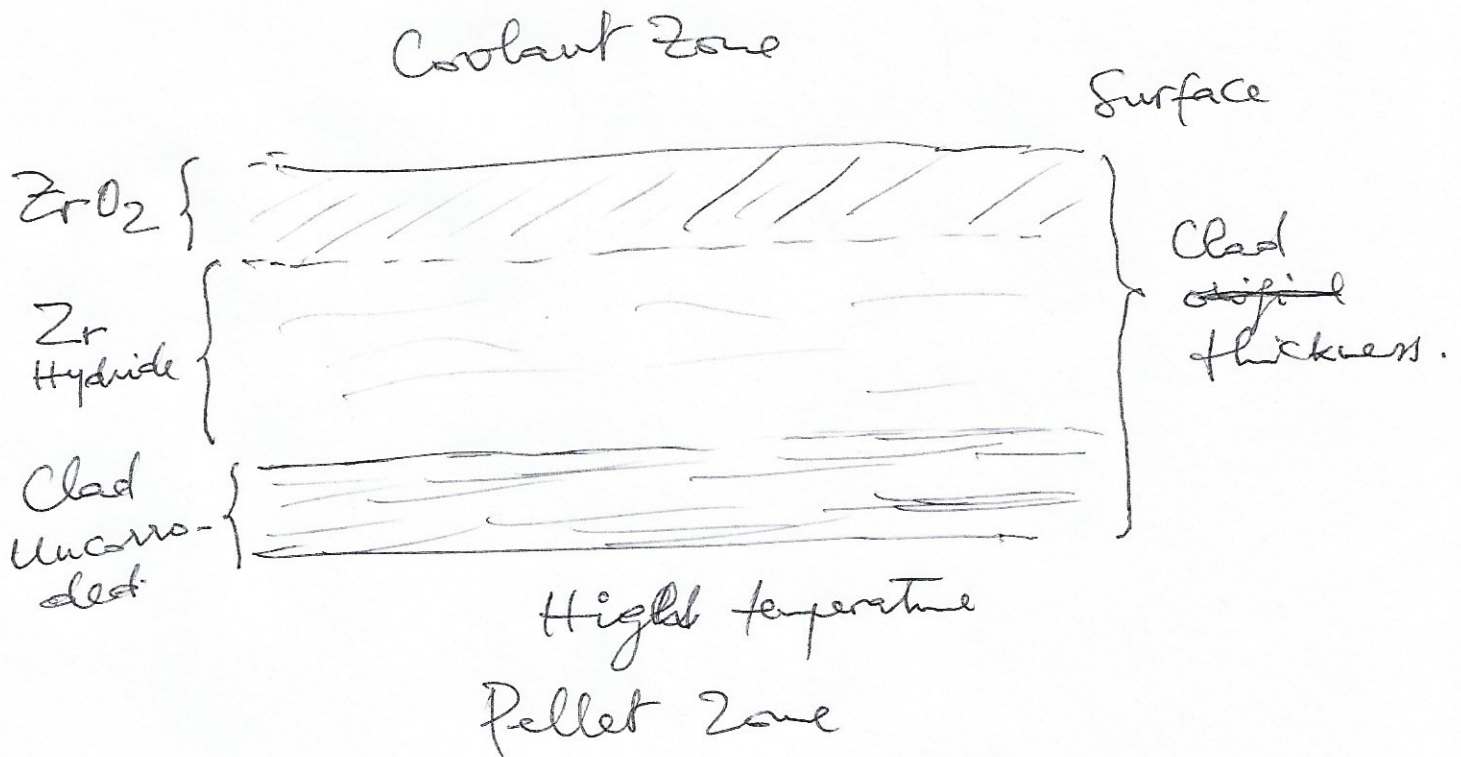
Problem 3

a) oxide weight gain

$$D_M = 2.23e^3 \times exp\left(\frac{-7620}{600}\right) = 18 \text{ microns}$$

d) microstructure changes

Coolant Zone

Surface

ZrO_2 {

Zr Hydride {

Clad Uncorro-ded {

Clad ~~original~~ thickness.

High temperature

Pellet Zone