

EXAMPLE:

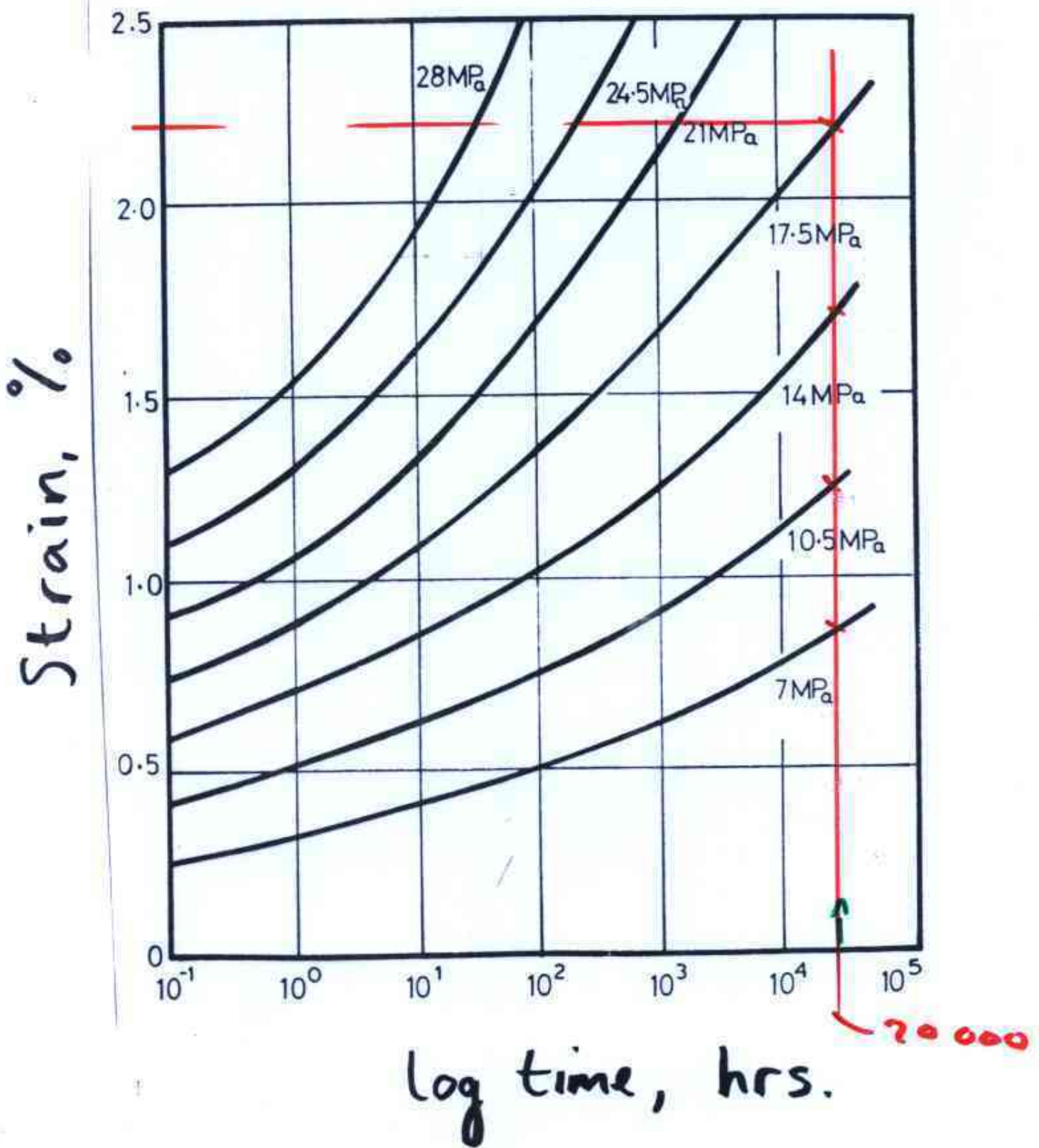
Thin walled plastic pipe subjected to an internal pressure of 0.7MPa. The service life of the pipe should be 20000 hrs with a maximum strain of 2%.

If the pipe diameter, d, is 150mm what is a suitable wall thickness?

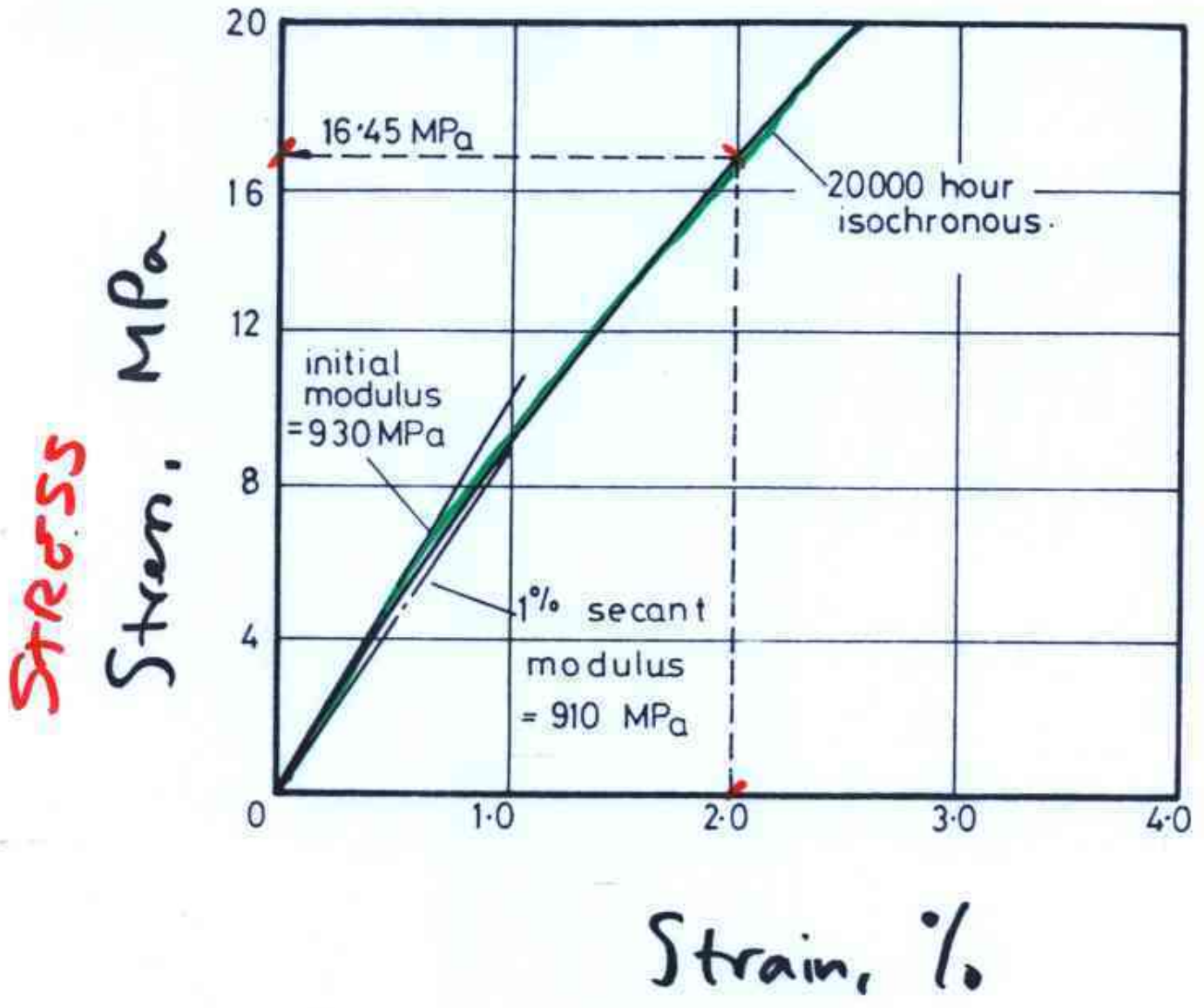
Data to be considered:

- creep curves for material
- 20000 hr isochronous (σ - ϵ) curve
- hoop stress in pipe wall

Creep curves at 20°C given below:



20000 hr isochronous curve given below:



Hoop stress given by:

$$\sigma = \frac{Pd}{2h}$$

Pressure
→ diameter
→ wall thickness

$$\Rightarrow h = \text{Wall thickness} = \frac{Pd}{2\sigma}$$

Design stress at 2% strain (after 20000 hrs):

from GRAPH 16.45MPa

20000 ISOCHRONAL
HOUR

$$\Rightarrow h = \frac{0.7 \cdot 150}{2 \cdot 16.45}$$

$$= 3.19 \text{ mm}$$

EXAMPLE:

Plastic beam 200mm long. → L

Simply supported at each end.

Point load, W , at centre span.

Same material as previous example.

If max. permissible strain in material is 1%
what is the largest load that can be applied
such that beam deflection, δ , does not exceed
5mm within 20000 hrs of use?

$$\delta = \frac{WL^3}{48EI}$$

↪ 2800 mm⁴