Industrial Glass Puzzle| *From Rockets to the Mundane.*

New Applications for Glass

Instruction: Match the illustrations to the types of industrial Glass.

Industry has produce some new glass types. These include:

- ❑ (a) **Quartz Glass**: (SiO_2) Operating Temperature 1,100°C; nominally 70 times as strong as normal glass, and thermal shock ΔT ~1000°C. Used for high-temp equipment & specialised lighting.
- ❑ (b) **PYROCERAM** ($2MgO\text{-}2Al_2O_3\text{-}5SiO_2$) Operating temperature 700 °C, nominally 7 times as strong as normal glass, and thermal shock ΔT ~up to 850°C. Used in high-temp rocket nose cones.
- ❑ (c) **Borosilicate glass** (70–80wt% SiO_2, 7–13wt% B_2O_3 4–8wt% Na_2O or K_2O, and 2–8wt% Al_2O_3) Operating temperature 230°C; nominally 5 times as strong as quartz glass, high chemical resistance, and thermal shock ΔT ~up to 170°C. Used in laboratory glassware. This glass has Mohs hardness of 7.2 (i.e topaz will scratch it, quartz will not.)
- ❑ (d) **Vitrelle Glass**: Safe operating temperature 175°C. Thermal shock resistance is same as normal glass. Annealed inner layer, and crystalline high compressive chip-free outer skin. Often used as a chip resistant replacement for porcelain applications.; non-porous compared to soda lime glass.

❑ 1

SURF BOARD

❑ 2

HALOGEN LAMP

❑ 3

CORELLE DINNER PLATES

❑ 4

LAB BEAKER

Industrial Glass Fibre:

Discussion 1: (e) **Glass fibre** is formed from a molten liquid state, forced through a platinum head with tiny holes. It has been used as fibre reinforcement for epoxy resins (fibreglass construction). Tensile Strength ~2800 MPa, 5% elongation to break and modulus of elasticity of ~72.4 GPa. Glass fabrics retain 50% of room temperature tensile strength at 370°C, 25% at 480°C. Safe working temperature of 250°C.

Discussion 2: (f) E Glass (55wt% SiO_2, CaO 19wt%, Al_2O_3 15wt%, Br_2O_3 7.5%, MgO 2.5wt%, Fluorides 1%wt, TiO 0.8%, balance of Na_2O, K_2O with traces of Iron oxide) Safe working temperature of 400°C. Alkali resistant glass fibre used in high strength fibreglass construction or reinforced polymers used in the electrical, power industry and wind-turbine blades; 3,400 MPa, 4.7% elongation to break and modulus of elasticity of ~72.0 GPa.

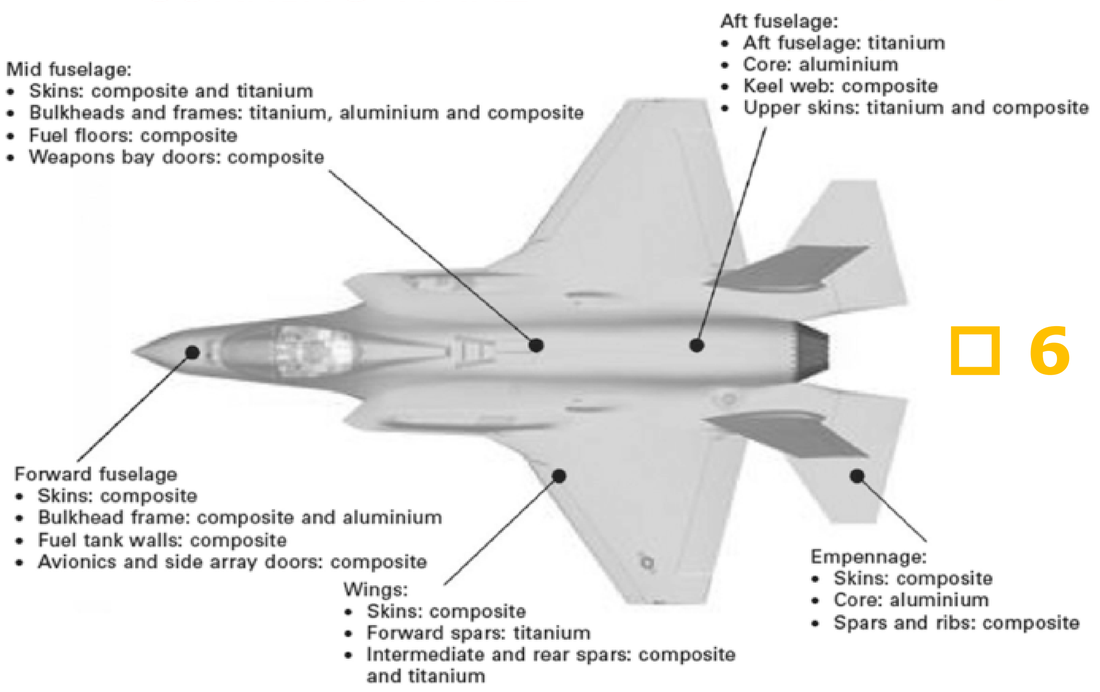
Discussion 3: (g) S Glass (65wt% SiO_2, CaO 0.3wt%, Al_2O_3 55wt%, MgO 10wt%, Safe working temperature of 540°C. Fluorides 1%wt, balance of Na_2O, K_2O with traces of Iron oxide) used for higher tensile applications in aerospace; 4,600 MPa, 5.2% elongation to break and modulus of elasticity of ~89 GPa.

❑ 5

CORNING WARE

☑ Which of these can be recycled and how?

❑ 6



❑ 7

WIND TURBINE

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