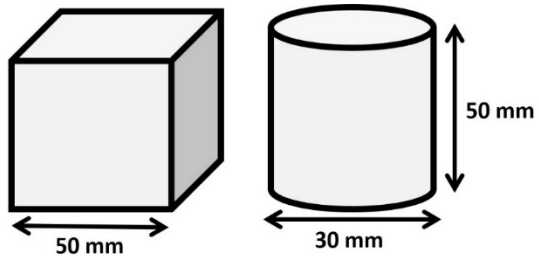
Numerical on Solidification Time

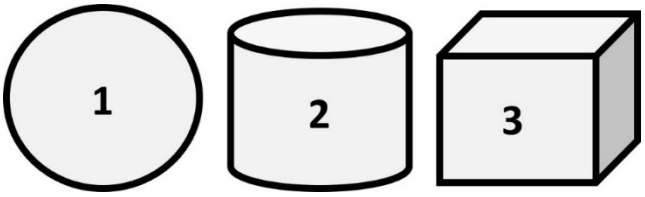
1.



In casting experiments performed using a certain alloy and type of sand mold, it took 160 seconds for a cube-shaped casting to solidify completely. The cube had a side of 50 mm.

A) Find the mold constant in min/cm^2, **B)** If the same alloy and mold type were used, find the total solidification time for a cylindrical casting of diameter = 30 mm and length = 50 mm.

2.



Total solidification times of three geometries are to be compared: (1) a sphere with diameter = 10 cm; (2) a cylinder with diameter and length both = 10 cm; and (3) a cube with each side = 10 cm. The same casting alloy and solidification conditions are used in all three cases. Which casting would solidify faster? The volume and surface areas of each part are listed below.

	Volume (cm^3)	Surface area (cm^2)
Sphere (1)	524	314
Cylinder (2)	785	471
Cube (3)	1000	600

3. Calculate the ratio of solidification time of a cube to that of sphere, given that surface area of a cube is equal to the surface area of sphere.

4. In a Slush casting process, a casting of thickness 6mm is formed when the mold is inverted after 121 sec and a thickness of 8mm is formed when the mold is inverted after 170 sec. what is the time after which the mold has to be inverted to produce the thickness of casting as 3mm?

   Note:
   In slush casting, only thickness of casting and solidification time are two variables of concern, so chvorinov's equation can be reduced to

   $$t = B_1\sqrt{T_s} + B_2$$

   where,
   T_s = Solidification time
   t= thickness of cast
   B1 and B2 are mold constants

5. Two cubical castings of the same metal and sizes of 2 cm side and 4 cm side are molded in a green sand. If the smaller casting solidifies in 2 mins, what will be the expected time of solidification for larger casting?