1. In casting, gating ratio is defined as the ratio of
   (a) sprue area : total runner area : total gate area
   (b) total gate area : sprue area : total runner area
   (c) total runner area : sprue area : total gate area
   (d) total runner area : total gate area : sprue area

2. In which of the gating systems molten metal flows into the mould cavity due to the adverse effect of gravity?
   (a) Top gating
   (b) Bottom gating
   (c) Parting gating
   (d) All of the above

3. In gating system, sprue is usually tapered to
   (a) Avoid air aspiration effect
   (b) Quick fill the mould cavity
   (c) Minimize the temperature
   (d) All of the above

4. The major function of choke is that
   (a) It controls the flow rate of molten metal
   (b) It does not control the flow rate of molten metal
   (c) It avoids the air aspiration effect
   (d) It controls the solidification time

5. The optimum pouring time for a casting depends on several factors. One important factor among them is
   (a) Location of riser
   (b) Porosity of sand mould
   (c) **Fluidity of casting metal**
   (d) Area of pouring basin

6. The connecting passage between bottom of sprue and ingate is
   (a) Pouring basin
   (b) Sprue
   (c) **Runner**
   (d) Ingate
7. During the filling process of a given sand mould cavity by molten metal through a horizontal runner of circular cross section, the frictional head loss of the molten metal in the runner will increase with the

(a) Increase in runner diameter

(b) Decrease internal surface roughness of the runner

(c) Decrease in length of runner

(d) Increase in average velocity of molten metal

**Solution:** Head loss due to friction in pipe when the molten metal flows through it = \( h_f \)

As we know that, \( h_f = \frac{4 f L V^2}{D \times 2g} \)

Where, \( L = \) Length of pipe
\( V = \) Average velocity of molten metal passing through the pipe
\( D = \) Diameter of pipe
\( f = \) Friction coefficient in pipe

So frictional head loss of the molten metal will increase with increase in average velocity of molten metal.

8. Characteristic of idle gating system is that

(a) Time taken for pouring or filling of molten metal into the cavity should be as minimum as possible

(b) Time taken for pouring or filling of molten metal into the cavity should be as maximum as possible

(c) Aspiration effect will take place during filling of molten metal into the casting cavity

(d) None of these

9. Which one is true for strainer

(a) It is used for avoiding sand erosion from bottom of sprue

(b) **It is acted as filter for separating the impurities present in molten metal**

(c) It is the last point of gating system from where the molten metal enters into the casting cavity
(d) It is a connecting passage between bottom of sprue and in gate

10. The height of sprue is selected such that velocity of molten metal in gating system must always ensure

(a) Laminar flow

(b) Turbulent flow

(c) May be laminar or turbulent

(d) None of these

11. A mould has a down sprue whose length is 20 cm and the cross-sectional area at the base of down sprue is 1 cm². The down sprue feeds a horizontal runner leading into the mould cavity of volume 1000 cm³. The time required to fill the mould cavity will be

(a) 4.05 sec
(b) 5.05 sec
(c) 6.05 sec
(d) 7.25 sec

**Solution:**

Time required to fill the mould cavity = \( t_m = \frac{\text{Volume of mould cavity}}{\text{Flow rate}} \) \( \ldots (1) \)

Volume of mould cavity = 1000 cm³

Flow rate = \( A_s \sqrt{2gh} \)

\( A_s = \) Cross sectional area at the base of down sprue = 1 cm²

\( h = \) length of down sprue

Putting the values in (1), we get that \( t_m = 5.05 \) sec

12. In a sand casting process, a sprue of 10 mm base diameter and 250 mm height leads to a runner which fills a cubical mould cavity of 100 mm size. The volume flow rate (in \( \text{mm}^3/\text{sec} \)) and the mould filling time (in second) are

(a) \( 0.8 \times 10^5, 2.8 \)
(b) \( 1.1 \times 10^5, 7.54 \)
(c) \( 1.7 \times 10^5, 5.78 \)
(d) \( 2.3 \times 10^5, 8.41 \)

**Solution:**

Given, \( D = 10 \) mm, \( h = 250 \) mm

Velocity of molten metal at the sprue end = \( V_1 = \sqrt{2gh} \)

Cross sectional area of sprue = \( A_1 = (\pi d^2/4) \)
Where \( d \) = diameter of sprue base

Flow rate = \( A_1V_1 = 173942.13 \text{ mm}^3/\text{sec} \)

Volume of mould = \( 100 \times 100 \times 100 \text{ mm}^3 \)

Mould filling time = Volume of mould / Flow rate = 5.75 sec

13. A cylinder of 150 mm diameter & 200 mm height is to be cast without any riser. The cylinder is moulded entirely in the drag of a green sand flask & top gated. The cope of the flask is 200 mm height & the height of metal during pouring is 50 mm above the cope. A tapered sprue is employed & the gating ratio is 1:1.5:2. The time taken (in seconds) to fill the casting cavity neglecting energy losses, if the in-gate area is 400 mm\(^2\)

(a) 2
(b) 4
(c) 8
(d) 15

Solution: Pouring time = \( V/Q \) …………. (1)

\[
V = \text{Volume of mould} = \left[\frac{\pi \times 150^2}{4}\right] \times 200 \text{ mm}^3
\]

\[
Q = \text{Flow rate} = \frac{200}{\sqrt{2}} \times 9.81 \times 1000 \times (200 + 50) \text{ mm}^3/\text{sec}
\]

Here area of sprue is half of gate area, according to the gating ratio

Putting all values in equation (1) we get that pouring time = 8 sec

14. The gating ratio of 1:2:4 is used to design the gating system for magnesium alloy casting. This gating ratio refers to the cross-section areas of the various gating elements as given below:

(i) Runner
(ii) In gates
(iii) Down sprue

The sequence of the above elements in the ratio 1:2:4 is

(a) i-ii-iii
(b) i-iii-ii
(c) ii-iii-i
(d) iii-i-ii

15. A mould having dimensions 100 mm \( \times 90 \text{ mm} \times 20 \text{ mm} \) is filled with molten metal through a gate with height ‘\( h \)’ and cross-sectional area \( A \), the mould filling time is \( t_1 \). The height is now quadrupled and the cross-sectional area is halved. The corresponding filling time is \( t_2 \). The ratio \( t_2/t_1 \) is

(a) 3
(b) 1
(c) 4
(d) 5
Solution: $T_1 = \frac{V}{A \times \sqrt{2gh}}$

Now, for $T_2$ we have $h_2 = 4 \ h$, $A_2 = A/2$

$T_2 = \frac{V}{[(A/2) \times \sqrt{2g \times 4h}]}$

So $T_2 / T_1 = 1$