CLASS-9 PHYSICS

Ch-4 , PRESSURE IN FLUIDS

NUMERICAL PROBLEMS (page no -74)

Q1-Calculate the pressure on a circular area of 100 cm^2 in a water of 100m deep.(Density of water =$10^3 kg/m^3$ and g= 10 m/s^2)

Solution- Area=100cm^2

Depth(h)= 100m

Density of water= $10^3 kg/m^3$

G= 10 m/s^2

Pressure = depth ×density ×acc.due to gravity

Pressure= $100\times10^3\times10$

= $10^6 N/m^2$

Q2- Calculate the force acting on the circular area in the above program.

Solution- force acting= Area× depth × density× acc.due to gravity

Force = $100/10000 \times100\times 10^3\times10$

= $10^4 N$

Q3- A hammer exerts a force of 1.5 N on a nail of tip area 2mm^2.Calculate the pressure on the nail.

Solution- force=1.5N

Area= 2mm^2= 0.000002m^2

Pressure= force/area

= 1.5N/0.000002m^2

= 7.5×10^5 pa

Q4- A wooden block of mass 7.5 kg of size 12cm × 8cm × 10cm is kept on a table top on its 12cm × 8 cm . Calculate (I) thrust (ii) pressure exerted on the top of table

Solution- mass = 7.5 kg

Area of table= (12× 8)cm^2= 96 cm^2= 0.0096 m^2

(i) thrust = m×g

7.5×10= 75N

(ii) pressure= force / area

= 75 × 0.0096

= 7812.5pa

Q5- The area of base of a cyclinder vessel is 0.03 m^2.Water density 10^3kg/ m^3 is poured into it upto a depth of 6cm . Calculate (i) pressure .

(ii) thrust of water on the base (g = 10 m/s^2)

Solution- area = 0.03m^2

Density of water(d)= 10^3kg/ m^3

h = 6 cm = 0.06m

g = 10 m / s^2

(i) pressure= depth× density × g

$0.06\times10^3\times10$
= 600pa

(ii) thrust = A× h× d× g

$0.03\times0.06\times 10^3\times10$

= 18N

Q6-Calculate the height of of water column which will exerts on its base the same pressure as the 0.70m of mercury column.Density of Hg is 13.6×10^3kg/m^3.

Solution- for water column

Let pressure= P1

Height = h1.

Density = D1= 10^3kg/m^3

And acc. due to gravity= g

Then ,P1= h1×10^3kg/m^3× g

Now ,for Mercury column

Let pressure= P2

Height of mercury column= h2 = 0.70 m

Density= D2= 13.6× 10^3kg/m^3

Acc. Due to gravity = g

Now P1=P2

$h1\times 10^3 kg/ m^3\times g= 0.70m\times 13.6\times 10^3 kg/m^3\times g$

h1= 0.70m×13.6

h1= 9.52m

Q7- The. Pressure difference between two floors of a building is 30000pascal.Find the vertical distance between the floors (density= $10^3 kg/m^3$, g= $10m/s^2$)

Solution- pressure difference= 30000 Pascal

Density of water = $10^3 kg/m^3$.

g = $10m/s^2$

We know, pressure= h× density × g

$30000=h\times 10^3\times 10$

h = 3m

Q8- In a hydraulic machine a force of 20 N is applied on the piston of area $10cm^2$.What force is obtained on its piston of area $100cm^2$.

Solution- F1= 20N

A1= $10cm^2$

F2=?

A2=$100cm^2$

We know P1=P2

So, F1/A1=F2/A2

f2= f1×A2/A1

F2= 20×100/10

f2= 200N

Q9- Calculate the ratio of area cross section of master cyclinder and wheel cylinder of hydraulic brake so that a force of 10N can be obtained at each of its brake shoe by exerting a force of 0.2N on the pedal.

Solution- for master cylinder

A1= ?

F1= 0.2N

For wheel cylinder

A2= ?

F2= 10N

When P1= P2

A1/A2= F1/f2

A1/A2= 0.2/100

A1:A2= 1:50

Q10- The area of pistons in a hydraulic machine are 5cm² and 125cm².What force on smaller piston will support a load of 1000N on the large piston.

Solution- A1= 5cm²

A2= 125cm²

F1=?

f2= 1000N

F1= f2×A1/A2

f2= 1000×5/125

f2= 40N

Q11- A force of 500N is applied to the smaller piston of a hydraulic machine.Find the force exerted on the large piston if the diameter of the piston are 5 cm and 25cm.

Solution- F1= 500N

F2= ?

D1= 5cm, So radius r= 5/2

Therefore A1= π×(5/2)²

A1= 25π/4

D2= 25cm, so radius= 25/2

Therefore. A2= π×(25/2)²

A2= 625π/4

Now f2= f1×A2/A1

f2=(500× 625π/4)÷25π/4

f2= 12500N

Q12-What force is applied on a piston of area of cross section 2.0 cm² to obtain a force of 240N on the piston of area 12.0cm² in a hydraulic machine.

Solution- F1= ?

A1= 2cm²

f2= 240N

A2 = 12cm²

F1= F2×A1/A2

F1= 240×2/12

F1= 40N

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Q1- Calculate the hydrostatic pressure at the depth of 100m in a sea water and also total pressure at this depth .(Density of sea water 1.03× 10^3kg/ m^3, atmospheric pressure= 10^5 N/ m^2 , g= 10m/s^2)

Solution- depth (h)= 100m

Density of sea water (d)= 1.03×10^3kg/m^3

g = 10m/s^2

Now hydrostatic pressure= h×d× g

= 100×1.03×10^3× 10

= 10.3 ×10^5pa

Atmospheric pressure= 10^5N /m^2

Total pressure= hydrostatic pressure+ atmospheric pressure

Total pressure=(10.3×10^5+ 10^5)pa

= 11.3×10^5pa

Q2- same as numerical -6 of page no 74

Q3- The base of a cyclinderical vessel is 300cm².water is poured upto a depth of 7cm . Calculate the pressure on the base(g= 10m/s^2, density of water= 10^3 m/s^2)

Solution- Base area = 300 cm²

Depth of water (h) = 7cm=0.7 m

g= 10m/s^2

Density of water (d) = 10^3kg/m^3

Pressure at the base= h×d× g

Pressure= $0.07\times10^3\times10$

=700pa

Q4- Atmospheric pressure= 720mm of Hg

Density of mercury (d)= 13.6×10^3

g = $10m/s^2$

h = 720mm= 0.720m

Pressure= h×d× g

Pressure= $0.720\times 13.6\times10^3\times10$

Pressure= 97920pa

Q5- Convert 2mm of mercury into N/m^2

(density of mercury= $13.6\times10^3 kg/m^3$, g= $9.8m/s^2$)

Solution- h= 2mm = 0.002m

Density of mercury (d)= $13.6\times 10^3 kg/m^3$

g= $9.8m/s^2$

Pressure= h×d×g

Pressure= $0.002\times13.6\times10^3\times9.8$

Pressure= $266.56Nm^2$