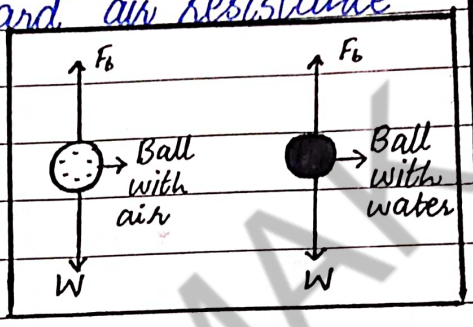
Q. No. 2 (i) **Reason:-** The lighter, air filled table tennis ball reaches terminal velocity first. Its mass is less for the same shape and size, so the friction force of upward air resistance become equals to the downward force i.e. weight sooner.



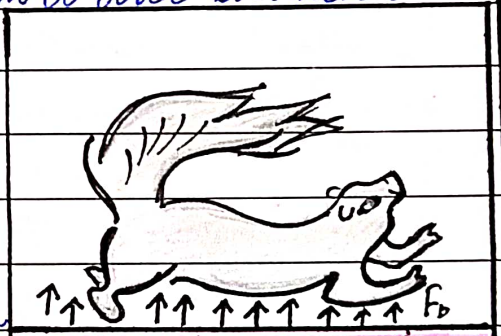
Mathematically:-

$$V_t = \frac{mg}{6\pi\eta r} = \frac{W}{6\pi\eta r}$$

the above equation shows that terminal velocity of a body is directly proportional to the weight of the object for same radius.

Conclusion:- As weight of the water-filled table-tennis ball (more mass) is larger, it's terminal velocity is larger and will reach first.

Q. No. 2 (ii) **Reason:-** A squirrel jumps from a tree branch to the ground and run away undamaged while a human could break a bone in such a fall.

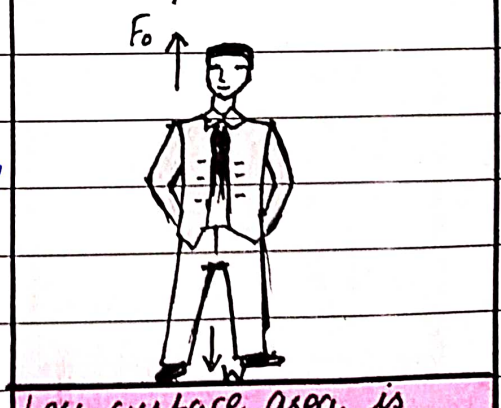


Relation of surface area and force:-

→ The squirrel jumps from a tree with extended legs. Surface exposed is maximum.

→ The squirrel faces large darg force and his terminal velocity is smaller.

→ On the other hand when human being falls it experience small drag force and has large terminal velocity.



Mathematically:-

$$V_t = W / 6\pi\eta r$$

Conclusion:- Because of it human being breaks a bone while squirrel don't.

Q. No. 2 (iii) The terminal velocity of a parachutist before opening the parachute is different from its terminal velocity after opening the parachute.

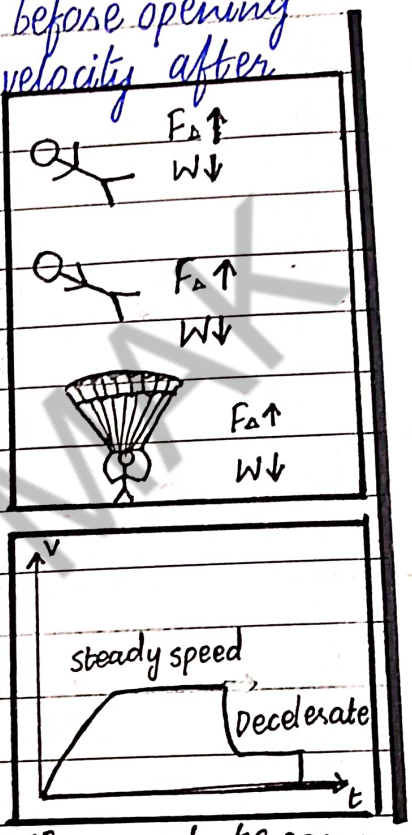
Before opening parachute:- When the parachutist is falling down without opening parachute air resistance is small. So, he experience less drag force and falls with high terminal velocity.

After opening parachute:- But when the parachute is opened surface area increase due to air resistance. So, he experience large drag force and falls with low terminal velocity.

Mathematically:-

$$V_t = W/6\pi\eta r$$

Conclusion:- So, a change in terminal velocity is observed.



After parachute opens deceleration can be seen

Q. No. 2 (iv) **Reason:-** Water squirt with greater distance by placing a thumb on the end of garden hose than by leaving it continuously uncovered.

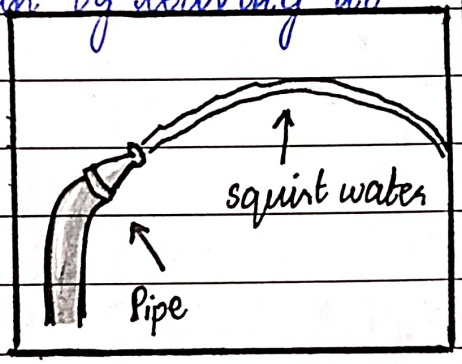
Mathematically:-

$$A_1V_1 = A_2V_2$$

OR

$$AV = \text{CONSTANT}$$

$$V = \frac{\text{constant}}{A}$$

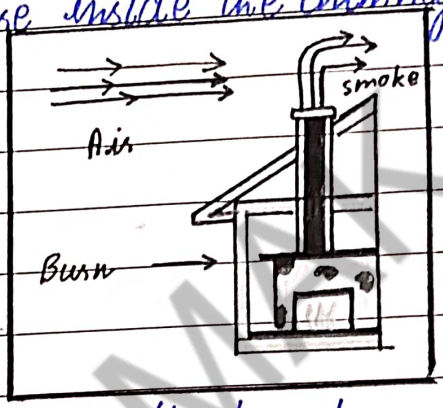


This equation shows that the speed of liquid emerging out is inversely proportional to the area of cross-section of that opening.

Relation of area and speed:- Now if we place our thumb over it, its area decreases while speed increases.

Conclusion:- In this way water can squirt over large distance.

Q. No. 2 (v) **Reason:-** The smoke rises faster in a chimney on a windy day due to difference in pressure inside the chimney and outside the chimney.



Bernoulli's Principle:- "Where the speed of fluid is high, the pressure will below and where speed of fluid is low pressure will be high."

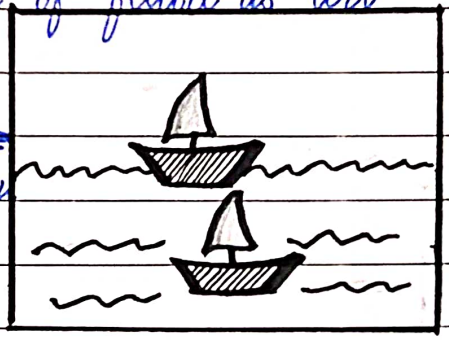
→ As the wind blows with high speed across the top of a chimney the pressure is low there than the inside pressure of chimney.

Mathematically:-

$$P + 1/2\,\rho v^2 + \rho g h = \text{Constant}$$

Conclusion:- The air & smoke are pushed upward from high pressure towards the low pressure.

Q. No. 2 (vi) **Bernoulli's Principle:-** "Where the speed is high, the pressure will be low and where speed of fluid is low pressure will be high."



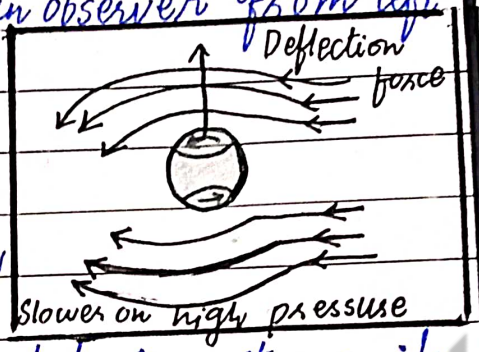
Pressure difference between the two boats:- As speed of water and air between the two boats is high, So, pressure difference between boats will be low. On the other side it will be the opposite.

Mathematically:-

$$P + 1/2\,\rho v^2 + \rho g h = \text{Constant}$$

Conclusion:- The force acts on the boats from high pressure towards low pressure which pulls the boats towards each other and they may collide.

Q. No. 2 (vii) A cricket ball moves past an observer from left to right, spinning counter clock wise.



Bernoulli's principle:-

"When the speed of fluid is high, pressure will be low and vice versa."

Reasons:- → In a spinning ball, the speed of air on its one side becomes high and the pressure of air will be low.

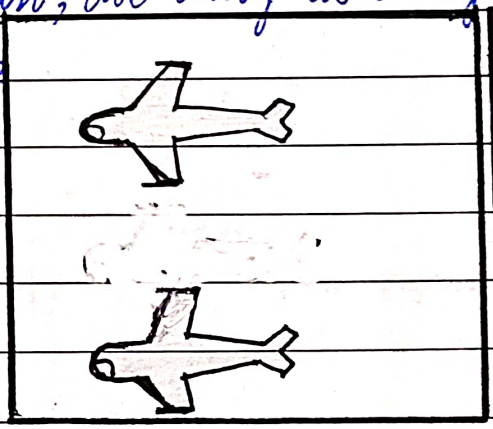
→ On the other side of the speed of air is low and pressure is high.

→ Hence the force acts on ball from high pressure towards low pressure which gives extra curvature to the ball.

Mathematically:-

$$F = \frac{1}{2} \rho A \{v_f^2 - v_i^2\}$$

Q. No. 2 (viii) **Reasons:-** → To fly upside down, the wing is designed in such a way that it can still provide lift even when inverted.



→ On a conventional aircraft, the aero foil is curved on the upper side and flat on the lower side. The air on the top of wing flows more quickly as compare to below the wing.

→ The difference in pressure gives the wing lift upwards.

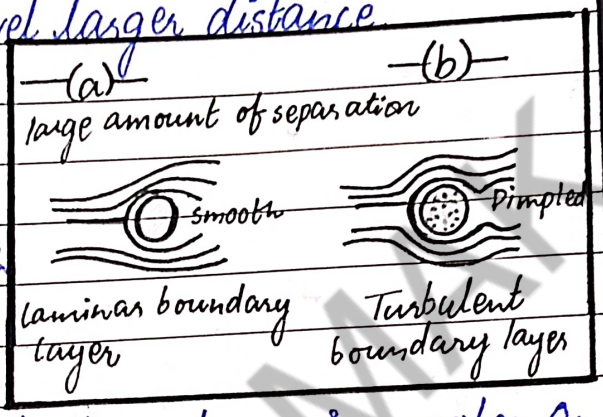
→ But wings on aerobatic planes are curved on both the upper and lower sides with this symmetric design the plane can fly either normally or inverted.

→ The pilot can flip from one to the other by altering angle of attack, for stunts the downside reduces the plane's fuel efficiency.

Q. No. 2 (ix) Golf balls have dimples, so that can move up in the air very high and can travel larger distance.

Reasons and explanation:-

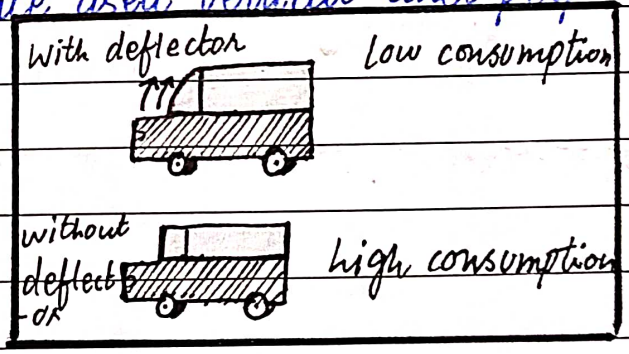
"Consider two balls figure (a) represents a ball without dimples while figure (b) represent a ball with dimples."



Without dimples:- The air passes smoothly with greater speed and drag force is greater. On the other hand large drag fosce slows down quickly and cover less distance.

With dimples:- On a golf dimples create a thin turbalent boundary layer of air that clings the ball surface and reduce drag fosce. Its drag is half of the smooth one.

Q. No. 2 (x) **Surface area perp. to truck's motion:-** The portion of the truck have a large surface area vertical and perpendicular to motion of the truck.



Role of wind deflector:- It changes airflow asound the vehicle. It also seduce air friction and increases fuel efficiency.

Energy loss:- If wind deflector is not present energy loss occurs because of which more fuel is used.

Conclusions:- So when friction is low speed of truck will be high in presence of wind deflector which seduce the fuel consumption.