

DYNAMICS OF CYCLING

Q1. A cyclist pedals his bicycle and moves forward on a flat pathway. The two wheels of the cycle rotate in a clockwise sense as the cycle moves towards right. Which of the following statements would be true about the frictional force on the wheels from the road?

- a. Friction acts backwards on the rear wheel and forward on the front wheel.
- b. Friction acts backwards on both wheels.
- c. Friction acts forward on the rear wheel and backward on the front wheel.
- d. Friction acts forward on both wheels.

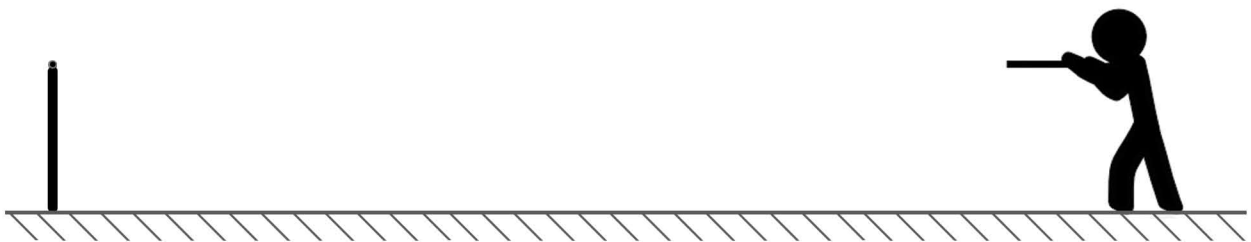
Note: here backward means opposite to motion of the bicycle and forward means towards the motion of the bicycle.



Ans.

KNOCK IT OVER

Q10. After a local cricket match is drawn, there happens a super over and coincidentally the super over is also drawn. Now the captains of the two teams decide to go for a stump shootout. The umpire pulls out the off and leg stump and the middle stump is left standing. Both captains are asked to stand at the other end of the wicket and shoot a bullet at the top of the stump. The one who knocks over the stump wins. One captain shoots with a real bullet and the other shoots with a rubber bullet. If the mass and speed of both bullets are same which captain has a better chance of knocking the stump over?

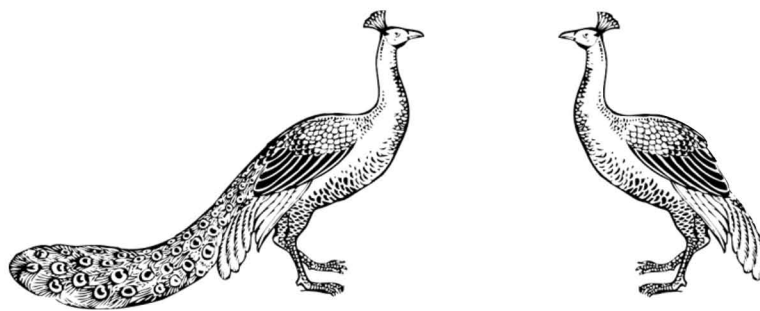


Ans.

GIFT OR CURSE

Q11. A peacock died at the jaws of a wolf and questioned God in the afterlife. He said “ you made my girl friend dull coloured, almost no tail and helped her camouflage in the wild, on the other hand you gave me a ridiculous blue, green color and magnificent tail feathers and made it impossible for me to hide. All my life I spent running and flying away and climbing trees to escape predators and even today the peahen lives and I am here. Why did you do this injustice to me. Why did you give me the curse disguised as beauty” ?

If you were to answer the peacock on behalf of God, what would your answer be?

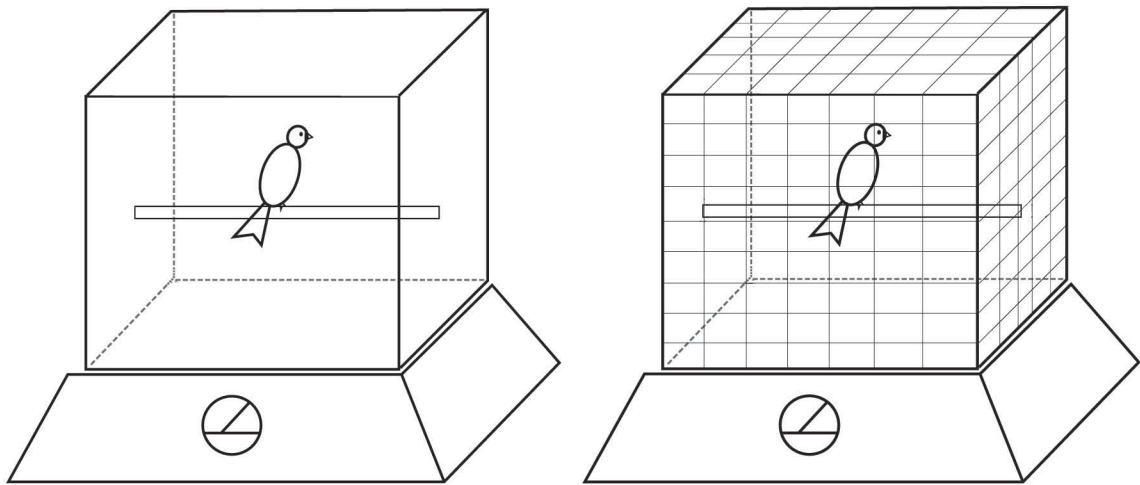


Hint: Think what role the brilliant colours and magnificent tail of a peacock plays.

Ans.

THE HOVERING BIRD

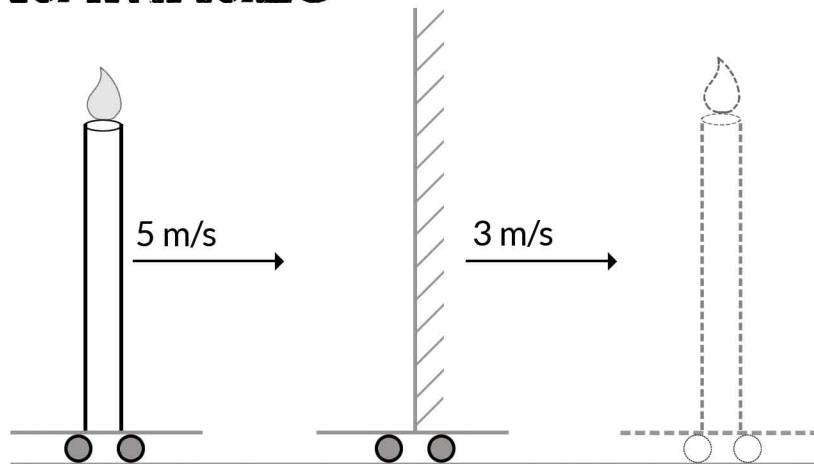
Q12. Two birds of exactly same mass are kept in two cages A and B. Cage A is made of glass and cage B is made of wire net. Both cages are kept on a weighing machine. While the birds are sitting on a bar fitted inside the cage the reading of the weighing machine is noted. If the birds now start flying and hovering in air in their cages, how do the readings in the weighing machine change?



Ans.

TRACING IMAGES

Q13.



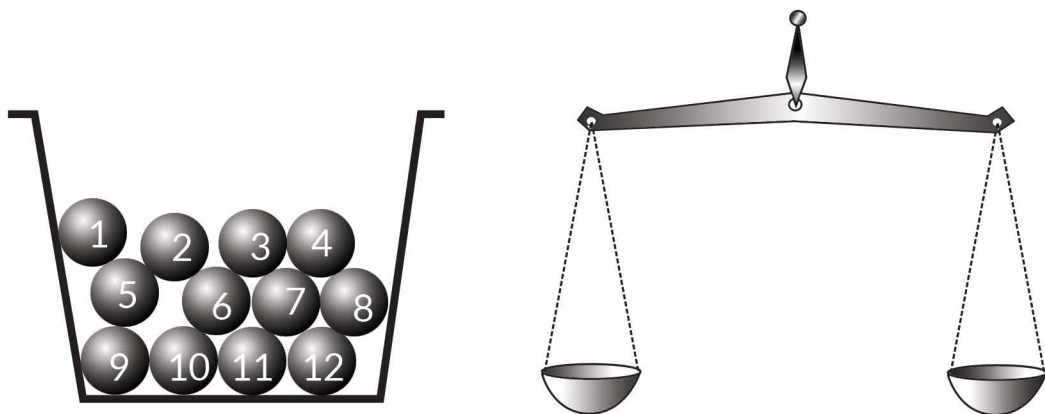
A mirror and a candle are placed on a horizontal ground. The candle moves towards the mirror with speed 5 m/s and the mirror moves away from the candle with speed 3 m/s . What will be the speed and direction of the image of the candle.

- (a) 2 m/s towards mirror.
- (b) 1 m/s away from the mirror.
- (c) 5 m/s towards mirror.
- (d) None of these.

Ans.

ODD BALL

Q14. You are given a basket full of identical looking balls. There are 12 balls which look the same. 11 of them also weigh the same but there is one ball which is either lighter or heavier than the rest of the balls. You borrow a beam balance (the type you see in vegetable markets with two pans and a horizontal beam) and have a maximum of 3 chances to use it. using these three chances or less suggest a method to find out which ball is the odd one out and whether it is heavier or lighter than the rest.



Ans.

THE LYING CLOCK

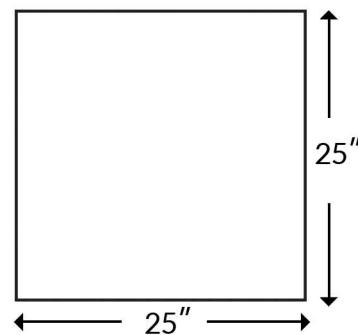
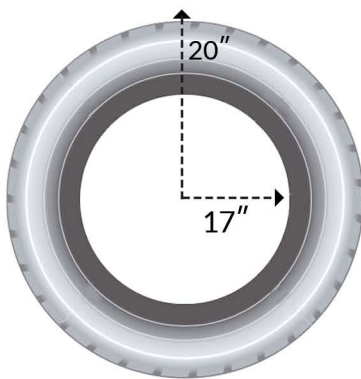
Q2. You have the misfortune to own an unreliable clock. This one loses exactly 24 minutes every hour. It is now showing 3:00am and you know that it was correct at midnight, when you set it. The clock stopped 1 hour ago, what is the correct time now?



Ans.

FINDING THE CENTER

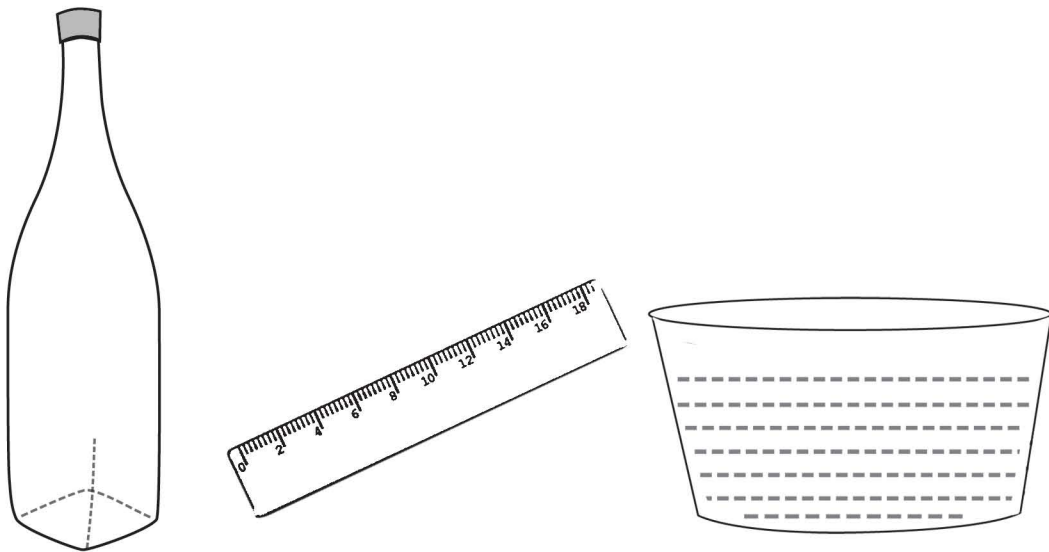
Q3. A tyre of inner radius 17 inches and outer radius 20 inches is given to you and you are to design an alloy wheel for it. The first step for you would be to locate the exact centre of the wheel and proceed to design around it. For locating the centre you have no compass, divider or any other measuring device. All you could find looking around is a square piece of cardboard of sides 25 inches, some paper pins and thread. Suggest a method to locate the centre of the wheel using all the above things.



Ans.

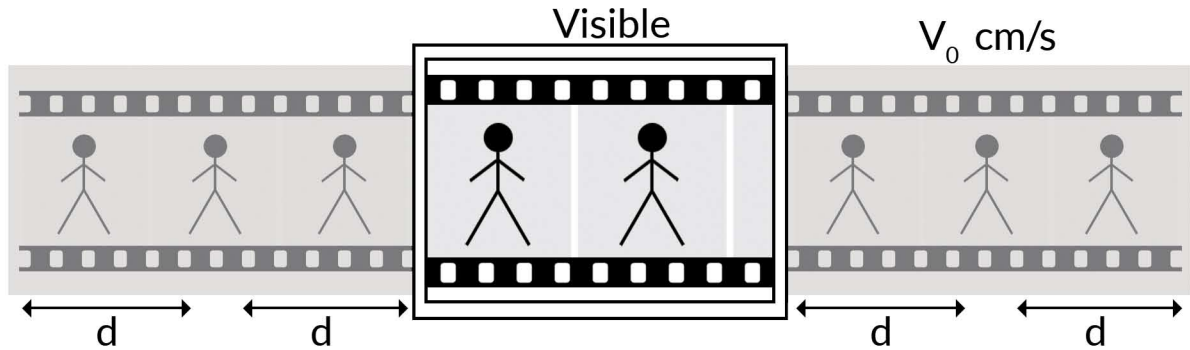
HOW BIG IS THE BOTTLE?

Q4. A glass bottle with a square base tapers towards the top and blends into a cylindrical neck. All you have as measuring tools is a ruler and a jar of water (unknown volume). Suggest a method to calculate the volume of the bottle.



Ans.

THE SHUTTER ILLUSION



Q5. A film strip has human figure markings (identical) uniformly marked on it at a distance ' d ' apart from each other. The strip is invisible to you except a window part which is open to viewing. The window has a shutter which just opens for a moment (click) ' f ' times per second. The film behind moves towards right with a velocity ' V_0 ' m/s. Answer the following questions based on the above situation.

i) What should be the value of V_0 so that you perceive the strip as stationary (not moving)?

(a) $V_0 = df$ (b) $V_0 = df/2$ (c) $V_0 = 2df$ (d) Not possible.

ii) What should be the value of V_0 so that you perceive the strip as moving towards left?

(a) $df < V_0 < 2df$ (b) $df/2 < V_0 < df$ (c) $V_0 = df/2$ (d) Not possible

iii) What should be the value of V_0 so that you perceive the strip as moving towards right?

(a) $V_0 > fd/d$ (b) $V_0 < fd/2$
 (c) $V_0 = df$ (d) always, irrespective of situation

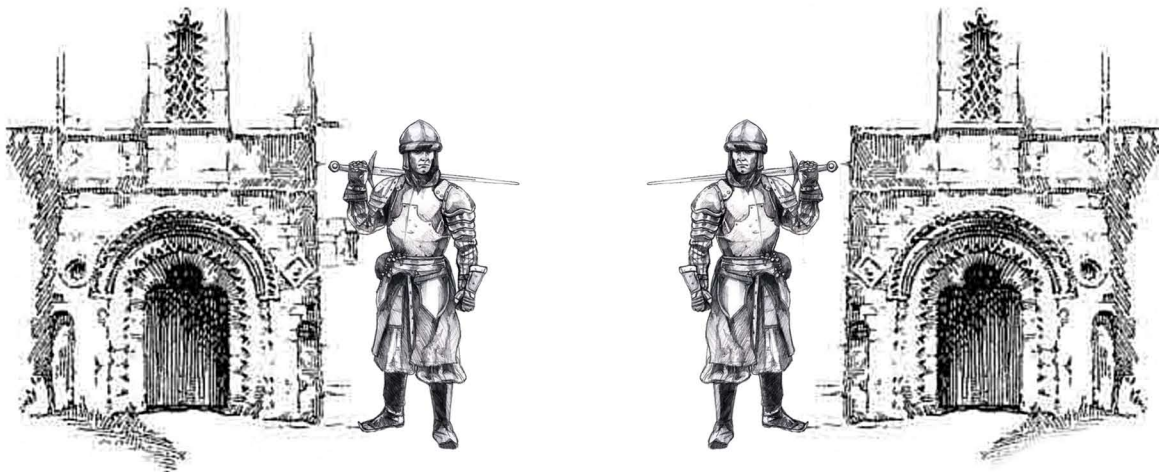
Ans.

GRAB THE TREASURE

Q6: There are two doors out of which one leads to the hidden gold of ancient kings and the other leads to a dark tunnel full of man eating goblins. In front of each door there is a door keeper who answer only in “Yes” or “No”. One of them always speaks the truth and the other always lies but you don’t know which one is truthful and which one is the liar. You can ask only one question to any one of the guards and your task is to reach the hidden treasure.

What question would you ask to complete your task?

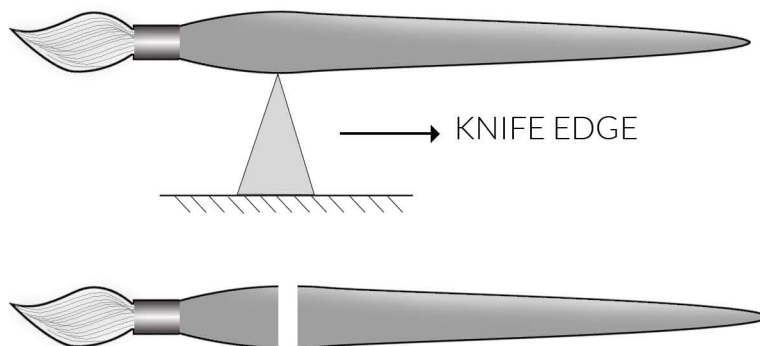
(note: the question has to be a “YES” or “NO” type question and can be asked only to any one of the guards.)



Ans.

BALANCED BRUSH

Q7. A paint brush is balanced on the edge of a knife and stays horizontal without any other external support. If the brush is broken into two pieces exactly at the point where it balances on the knife edge and the two pieces are weighed which piece will weigh more? The longer one or the shorter one.



Ans.

TRUE OR FALSE

Q8. There are 6 statements given below and a space provided in front of all of them. Mark the statements as true or false with correct explanation for ur answer in the space provided below each statement.

a. An insect flying through the air smacks into the windshield of a rapidly-moving train. The force the windshield exerts on the insect is higher than the force the insect exerts on the windshield.

b. A cloud is made primarily of water vapor.

c. If a car hits a tree, the car's occupants (assume no seat belts or air bags) will be violently thrown forward due to a force created by the car seats.

(to be continued)

TRUE OR FALSE (from previous page)

d. The force between your feet and the floor is greater while standing on your tiptoes than while standing flat on your feet.

e. If an object is placed in water and sinks, it is because it has no buoyancy force acting on it.

f. A solid object like a rock is almost entirely filled with empty space and only feels solid due to electrical repulsion forces.

FEELING HOT !

Q9. It's well known that the sense of hot or cold is not absolute. The same object can feel hot to someone and cold to someone else. If you touch something which is at a higher temperature than your hands you will feel hot and if you touch something which is at lower temperature than your hands you will feel cold. Normal temperature of a human body is 37 degree celsius but we feel hot even when the environment temperatures are anywhere above 30 degrees. Explain this contradictory phenomena how we feel hot even at temperatures lesser than our body temperature.



Ans.