

CONCEPT
BRAINSTORM 
2015

Scholarship test for 10th appeared students

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Name

School

Address.....

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Phone

INSTRUCTIONS

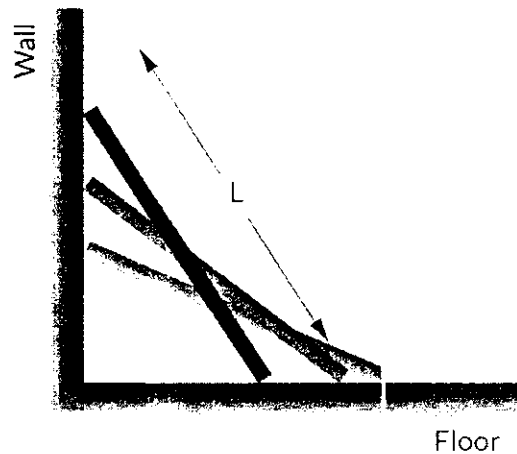
- Total time allotted is 1 hour.
- Each question carries 5 marks; except Question 6.
- Question 6 carries $3 \times 5 = 15$ marks
- All questions are compulsory.
- Answers without explanations will not be evaluated.
- Explanations can be of mathematical or analytical type.
- If you use extra sheets for explanations, attach them with your answer booklet before submission.
- Try and keep the answer book readable and comprehensible.

CATCH THE CENTRE

Q1: A thin ruler stands vertically along a wall at the edge of a horizontal floor. The ruler starts sliding down due to a slight disturbance. At all moments during the slide, the ends of the ruler remain in contact with the vertical wall and horizontal floor. What will be the locus of the centre of the ruler as the ruler falls? (Mention the shape.)

Note: A locus is the path of a point traced in space.

You can also try to draw the locus, if you can not name it.

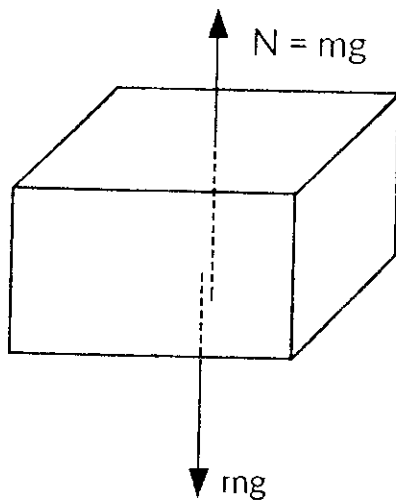


Ans.

WHAT IS THE BLOCK DOING?

Q2: Shown here is the force diagram (Free body diagram) of a small block of mass m . N is the normal reaction and mg is of course gravitational pull. This could be the force diagram of :

- (a) A block kept at rest on the top of a table
- (b) A block moving vertically upwards with velocity 5m/s .
- (c) A block moving vertically downwards with velocity 5m/s .
- (d) A block moving horizontally with velocity 5m/s .

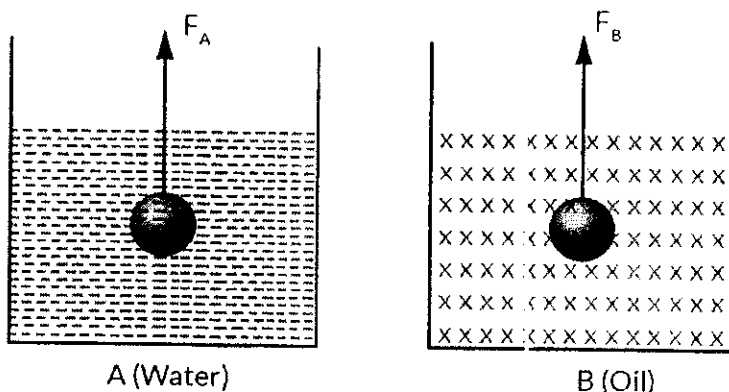


Ans.

AMAZING ARCHIMEDES

Q3: Two balls of the same size (one made of iron and the other made of plastic) are placed inside two containers containing water and oil. Let F_A and F_B be the buoyant force experienced by the two balls. Which of the following is correct?

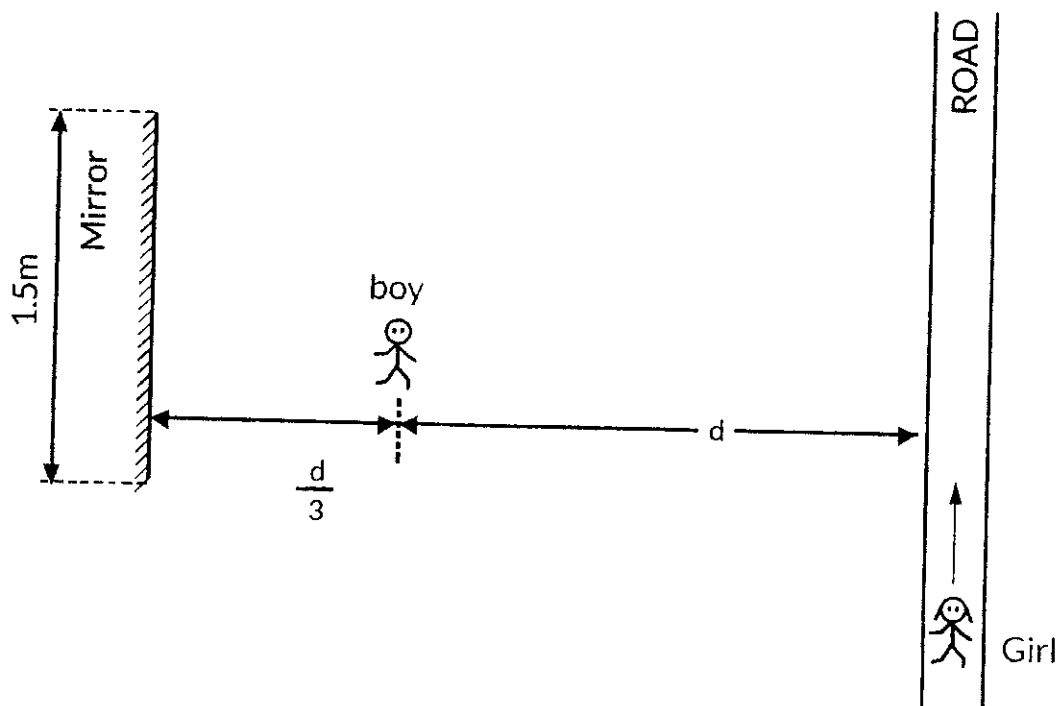
- (a) $F_A > F_B$ (b) $F_A < F_B$ (c) $F_A = F_B$
(d) We need to know which ball is submerged in which liquid to conclude.



Ans.

STALKER BOY

Q4: A boy stands in front of a mirrored window of a shop which is 1.5m wide. On a straight road behind him walks a girl with speed 0.5m/s. The distance between the boy and the mirror is one third the distance between the boy and the straight road. For what maximum duration will the boy be able to see the girl in the mirror.

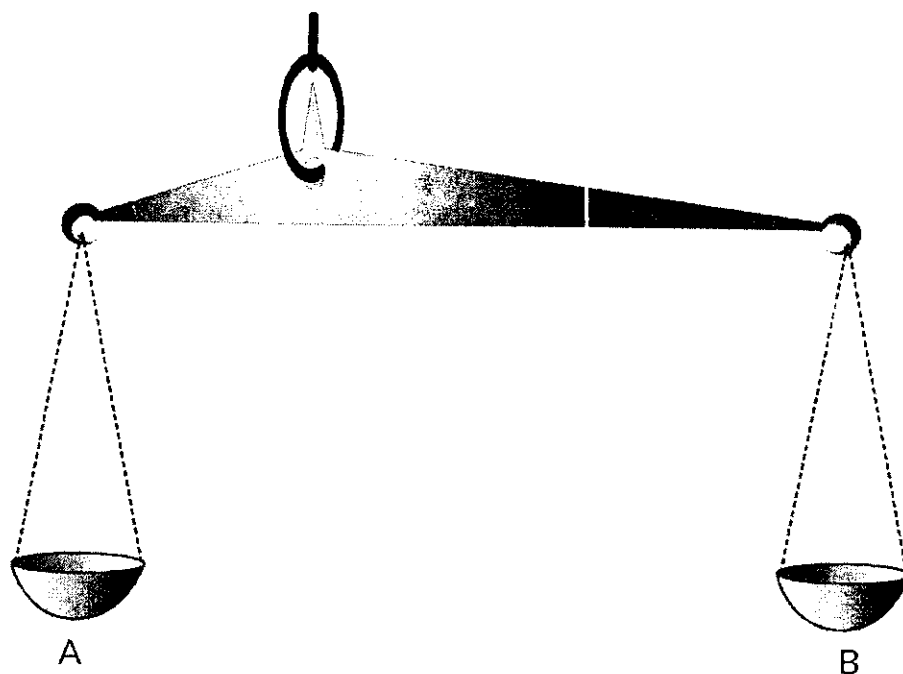


Ans.

THE CONFUSED BEAM BALANCE

Q5: A vegetable seller uses a beam balance as shown in the figure. He puts the weight stones in pan B and vegetables in pan A always. Will buying vegetables from this seller cause you a loss or gain? Explain your answer.

Hints : Do you notice something wrong in the beam balance.



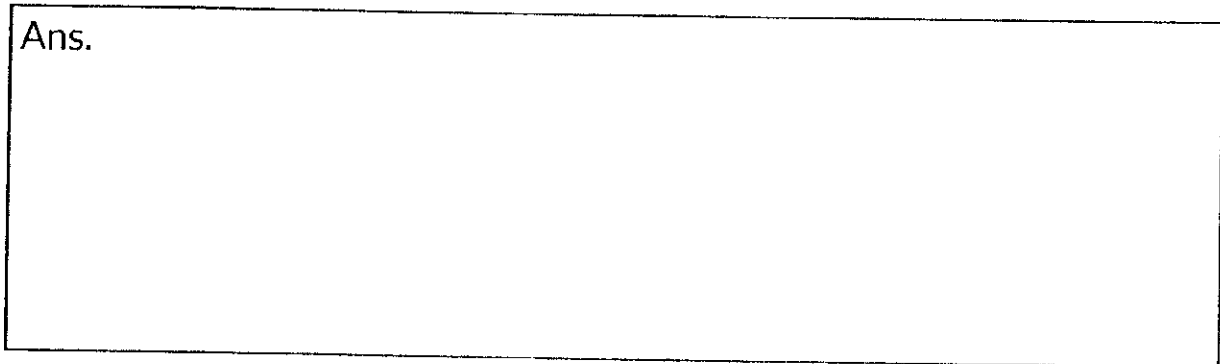
Ans.

REALITY OR MYTH

Q6: Listed below are some common everyday statements that we hear. Identify which of these are true/false and justify your answer.

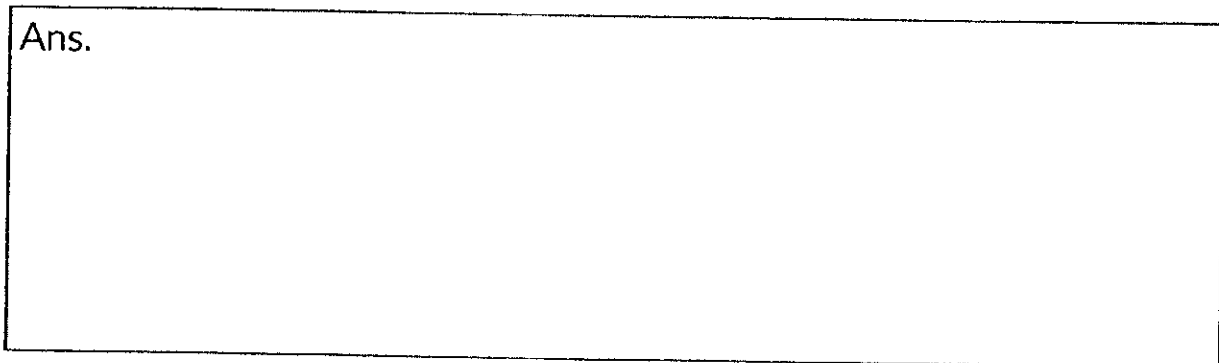
(a) The sun is yellow in colour and not orange or red as shown in pictures.

Ans.



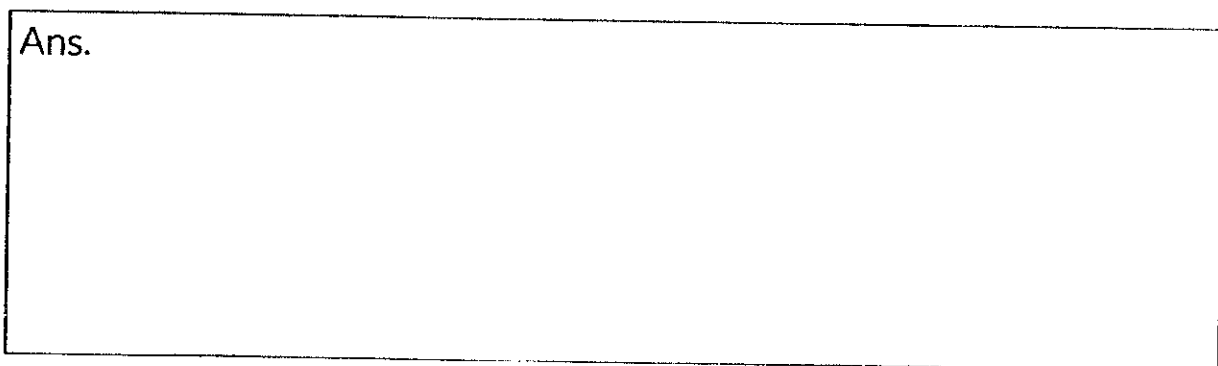
(b) Gravity exists every where, even on the moon. Only in space, gravity does not exist.

Ans.



(c) When going out in cold weather you should always wear warm clothes to avoid catching a cold.

Ans.



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REALITY OR MYTH

(from the previous page)

(d) We only use about 10-14% of our brain.

Ans.

(e) Summer and winter happen because the orbit of the earth around the sun is not round but elliptical which creates different distances between the sun and the earth at different times of the year.

Ans.

UNDERSTANDING EXPONENTS

Q7: Exponential Expression are considered to denote repeated multiplications of the same number. For example

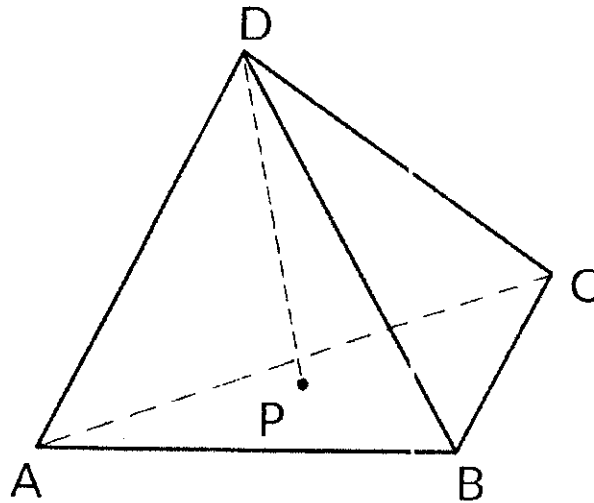
$$a^3 = a \times a \times a \quad \text{or} \quad b^n = \underbrace{b \times b \times b \dots \times b}_{n \text{ times}}$$

is this fact universally true for all real numbers. Why or why not?

Ans.

PYRAMIDS PILLAR

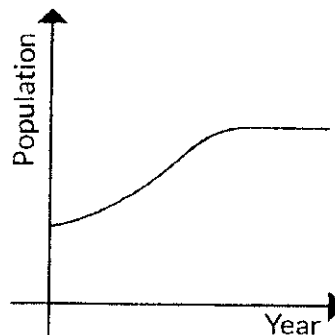
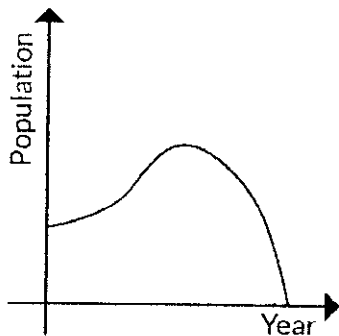
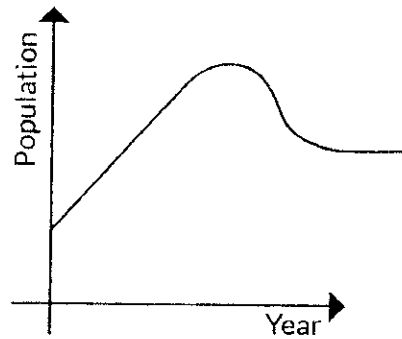
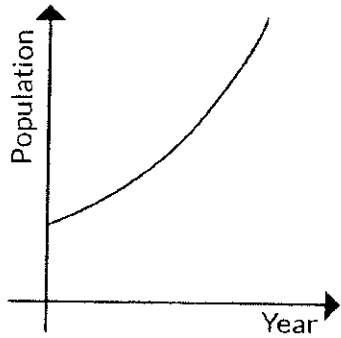
Q8: You have been familiar to an equilateral triangle. Here is an equilateral pyramid. The sides of the base triangle AB , BC , CA and the edges AD , BD , CD are all equal to 10cm . A vertical line is dropped from D to the base triangle ABC . Find the length of the line DP .



Ans.

WHERE TIGERS RULE

Q9: Imagine a forest with tigers as the main predator (carnivore) and deer as the main prey (herbivore). If the entire tiger population is wiped out suddenly (God forbid), which of the following diagrams will best represent the population growth of deer in the subsequent years?

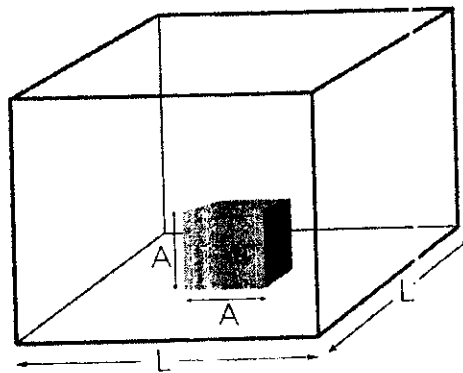


Ans.

GLOBAL WARMING

Q10: A container with square base of side length $L = 10$ cm has a cube of ice of side length $A = 4$ cm placed in it. When the ice starts melting, water starts filling up in the container. It is observed that after melting down to a certain size the ice cube lifts from the base of the container and starts floating partially in it's own water. It is given that the density of ice cube is $\frac{2}{5}$ th the density of water. Find the size of the ice cube when it loses contact with the bottom of the vessel.

Note: Assume that the ice cube melts uniformly from all sides.



Ans.