cmi TESSELLATE PRESENTS 

Scholastic Test of Excellence in Mathematical Sciences

powered by

Physics Exam

Category A Practice Paper

October 14, 2018

Rules and Regulations

Marking Scheme

1. The question paper is divided in two parts: Objective and Subjective.
2. Each objective question is worth **2 point** and there is no negative marking.
3. You are not required to show your work for the objective part of the paper.
4. Each subjective problem is worth **10 points**.
5. For getting full credit in the subjective questions you need to give the detailed solutions. However, credit will also be awarded for partially correct solutions.
6. There is no negative marking in the subjective section as well.
7. **The subjective part will be graded only if you score above a certain cut-off (which will be decide later) in the objective section of the paper. However, for the final score, your total score (subjective + objective) will be taken into consideration.**

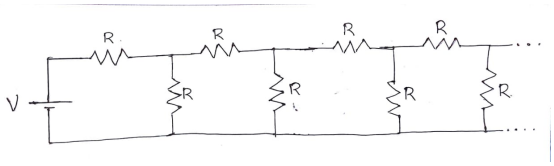
Miscellaneous

1. Any form of plagiarism will lead to disqualification
2. For solving the problems, you are allowed to use the Internet and books as resources.
3. Write the answer clearly, in a legible way. Write formal proofs wherever necessary. Be clear with your reasoning.
4. You are not allowed to post/discuss the problems in any online forum within the exam time.

Objective Questions

For **Problems 1-10**, each problem has **four** options, namely **(a), (b), (c), (d)**, of which ***only one*** is correct, **2 point** will be awarded for correctly answering a problem, **NO** negative marks shall be awarded for wrong answers/unattempted problems .

Problem 1. *Find the resistance of this infinite resistor circuit*



(a) $\dfrac{\sqrt{5}+1}{4}$

(b) $\dfrac{\sqrt{5}-1}{4}$

(c) 0

(d) *None of these*

Problem 2. *A car is moving with constant velocity v along a straight line. A person sitting in the car throws a ball up. Then which of the following option is correct:*

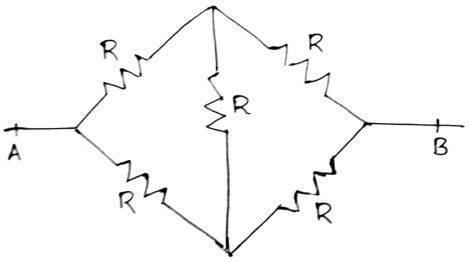
(a) *the ball falls behind the car*

(b) *it falls ahead of the car*

(c) *it falls on the car*

(d) *cannot be determined*

Problem 3. *Find the resistance across A and B*



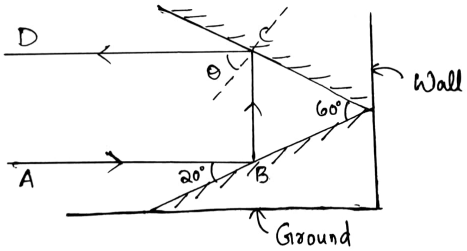
(a) $2R$

(b) $5R$

(c) $\frac{5}{2}R$

(d) R

Problem 4. *A ray of light AB is incident on a mirror as shown in the figure. The final reflected wave CD is parallel to the ground. Find θ*



(a) 20°

(b) 70°

(c) 40°

(d) 60°

Problem 5. *A person standing on the top of a building throws a ball with velocity v upwards. When it comes back and reaches the height of the building the person drops another ball B to the ground. Then*

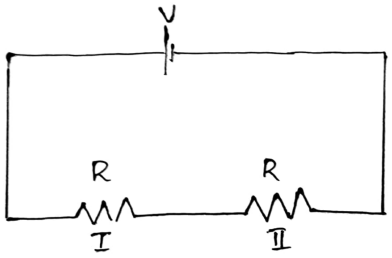
(a) *Both balls reach ground at same time*

(b) *A reaches first*

(c) *B reaches first*

(d) *Depends on v*

Problem 6. *A circuit consists of two resistors connected as shown in the figure. Let H be the heat produced in this case in unit time. What is the heat produced if first resistor's resistance is halved and other is doubled.*



(a) H

(b) $\frac{H}{5}$

(c) $\frac{3H}{5}$

(d) $\frac{4H}{5}$

Problem 7. *Velocity of a particle is given by* $v(t) = v_0 \sin(t)$ *for* $0 \leq t \leq 2\pi$. *Find the total displacement*

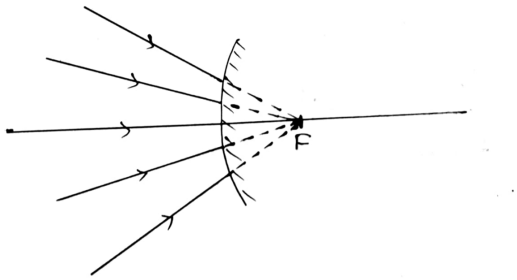
(a) *0*

(b) v_0

(c) $2v_0$

(d) $3v_0$

Problem 8. *What happens to the reflected rays in this case?*



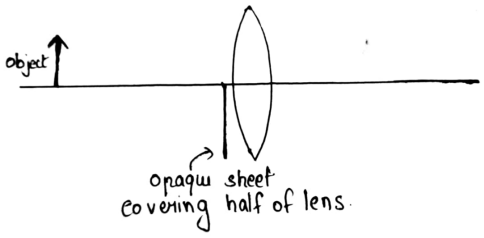
(a) *They all retrace their path*

(b) *They all move parallel to principal axis*

(c) *The reflected ray scatter randomly*

(d) *None of the above*

Problem 9. *An object is placed before a convex mirror and an image is formed. Now half of the mirror is covered with a opaque sheet. What happens to the image formed*



(a) *Brightness decreases with full image retained with same size*

(b) *Size of image decreases*

(c) *Only half of the image is formed*

(d) *None of the above*

Problem 10. *A satellite is orbiting earth at height* $30000km$. *If the time period of rotation around earth is 24 hours. Calculate the work done by satellite in one day due to gravitational force (mass of satellite is M kg)*

(a) $3.6\pi \times 10^{11} M\ J$

(b) $2.1 \times 10^{11} M\ J$

BRILLIANT
Math and science done right

(c) $0\ J$

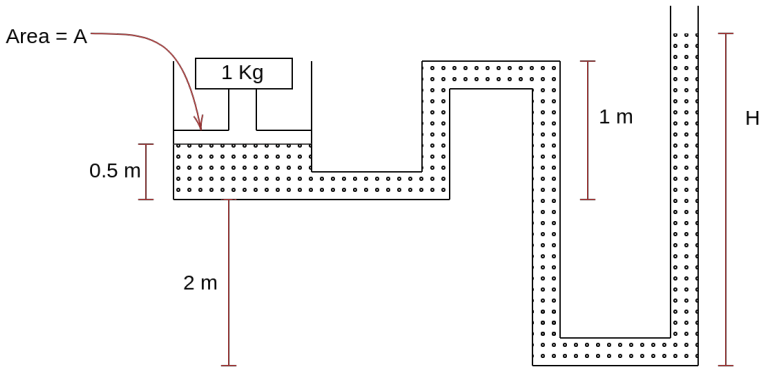
(d) $200\ J$

Subjective Problems

Problem 1. *A body of mass 1 kg moving with velocity $2m/s$ in X direction collide with a body of same mass moving with $1m/s$ in negative X direction to form a single body. Now this body collides with a body of mass 1 kg moving in Y direction with speed $1m/s$ to form a single body again. Find the magnitude of velocity for this body.*

Problem 2. *Three people A,B and C are situated at vertices of an equilateral triangle at time $t = 0$. Each person has a constant speed moving such that*
a)A always moves towards B
b)B always moves towards C
c)C always moves towards A
Will they ever meet? If yes, in what time.

Problem 3. *A friction-less piston attached to one side of container with a fluid of density ρ. What is the height H if a body attached to the piston as shown in the figure stays in equilibrium(Area of cross section $A = \pi m^2$).*



(Figure not to scale)