2022 MIT Science Bowl High School Invitational Tiebreak Round 9

TOSSUP

1) CHEMISTRY *Multiple Choice* Which of the following organic compounds displays pi conjugation across each carbon atom in its structure?

W) Cyclobutadiene
X) Cyclopentadiene
Y) 1,3,5-hexatriene
Z) Butyric acid (*byoo-TIR-ik acid*)

ANSWER: Y) 1,3,5-hexatriene

TOSS UP

2) EARTH AND SPACE *Multiple Choice* The James Webb Space Telescope is deployed in a solar orbit near which of the following Sun-Earth Lagrange points?

W) L_1
X) L_2
Y) L_3
Z) L_4

ANSWER: X) L_2

TOSS UP

3) PHYSICS *Short Answer* A simple pendulum of length L and mass m is initially at rest. Isaac then pushes the pendulum until it makes a small angle θ (read: *theta*) with the vertical. If the gravitational acceleration is g, which of the following is closest to the work done by Isaac?

W) $mgL\sin\theta$
X) $mgL\cos\theta$
Y) $mgL\theta$
Z) $mgL\theta^2/2$

ANSWER: Z) $mgL\theta^2/2$

TOSS UP

4) BIOLOGY *Multiple Choice* Which of the following blood types CANNOT be produced by a mother that is type O+?

W) O-
X) A-
Y) B+
Z) AB-

ANSWER: Z) AB-

TOSS UP

5) MATH *Short Answer* In polar coordinates, what is the center of the circle given by the equation $r^2 - 4r\sin\theta = 0$?

ANSWER: $(2, \pi/2)$ (ACCEPT: $r = 2, \theta = \pi/2$)
