Senior Physics Challenge Online Competition – 10 Sample Questions

Q1

Here are five physical quantities: mass, weight, acceleration, momentum, temperature. How many of them are scalar quantities?

A. 1

B. 2

C. 3

D. 4

E. 5

Q2

A body of mass 4 kg is accelerated from rest by a constant force of 9 N. What is its speed when it has travelled a distance of 8 m?

A. 3.6 m s^{-1}

B. 4.5 m s^{-1}

C. 6.0 m s^{-1}

D. 18.0 m s^{-1}

E. 36.0 m s^{-1}

Q3

An insulating belt, such as is found in an electrostatic generator, has a width of 10 cm and travels at a speed of 20 cm s^{-1}. It is charged on one surface with a charge density of 50 μC m-2.

What is the current due to this flow of charge?

A. 1.0 x 10^{-6} A

B. 4.0 x 10^{-6} A

C. 1.0 x 10^{-4} A

D. 4.0 x 10^{-4} A

E. 1.0 x 10^{-2} A

Q4

The circuit shows a cell of negligible internal resistance connected to two resistors, R_1 and R_2, an ideal ammeter and an ideal voltmeter. Which of the following expressions for either the voltage or the current is correct?
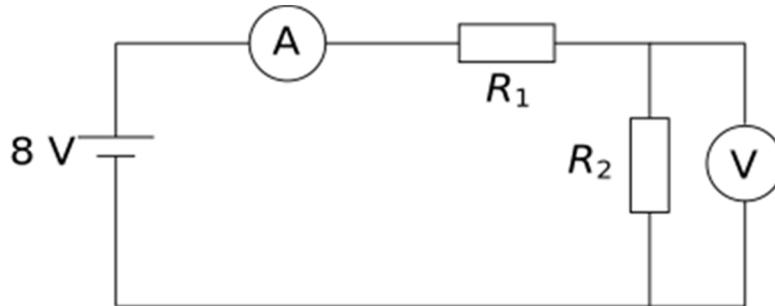
A. Voltmeter reading is $8\ R_2/R_1$

B. Voltmeter reading is $8\ R_1/(R_1 + R_2)$

C. Ammeter reading is $8/R_1$

D. Ammeter reading is $8/R_2$

E. Ammeter reading is $8/(R_1 + R_2)$

Q5

A string of length 1 m, which is fixed at the ends, is plucked at the centre and a standing wave is produced. There is a single antinode at the centre. The frequency of oscillation is 5 Hz.

The speed of waves along the string is

A. $2.5\ \text{m s}^{-1}$

B. $5.0\ \text{m s}^{-1}$

C. $10\ \text{m s}^{-1}$

D. $15\ \text{m s}^{-1}$

E. $20\ \text{m s}^{-1}$

Q6

SA and SB are two similar, small loudspeakers 0.5 m apart. They are connected to a signal generator and sound waves are generated in phase, with a wavelength of 0.40 m. A small microphone is used to detect a minimum in the interference pattern at point P, which is 12.00 m from SB. The distance PSA > PSB.
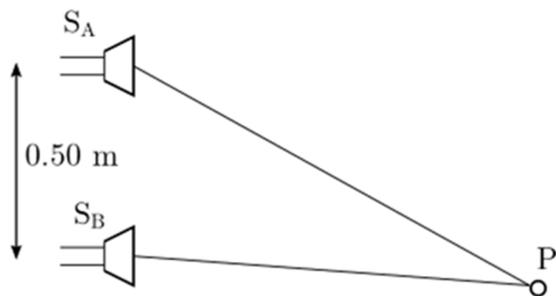
The least possible distance of P from SA is

A. 12.15 m

B. 12.20 m

C. 12.40 m

D. 12.50 m

E. 13.00 m

Q7

The maximum speed, v, at which the tip of a rotating propeller may travel without breaking depends only upon the breaking stress, S, in N m^{-2} and the density, ρ, of the material from which it is made.

The square of the maximum speed, v^2, is proportional to

A. $(S/\rho)^2$

B. S^4/ρ^2

C. S/ρ^2

D. S^2/ρ

E. S/ρ

Q8

A length of wire has a load attached to one end. It is stretched by an amount e. A second wire, made from the same material, has twice the length and half the radius. It is stretched by the same load.

The extension of the second wire will be

  A. e/2

  B. e

  C. 2e

  D. 4e

  E. 8e

Q9

In a 3-minute shower, 1.5 kg of water is used every ten seconds.

Estimate the number of droplets of water that are produced by the shower head during the shower.

  A. 10^4

  B. 10^6

  C. 10^9

  D. 10^{12}

  E. 10^{14}

Q10

Here are the five Noble Prize winners for Physics and Chemistry for 2020. Which one is the UK Nobel Prize winning physicist?

  A. J.A. Doudna

  B. R. Genzel

  C. A. Ghez

  D. E. Charpentier

  E. R. Penrose