Physics 1004 Practice Questions

Section A: Multiple Choice

Answer all questions. Each question is worth 1 mark. Please circle your answer in the box.

A1

A 12.0 N force with a fixed orientation does work on a particle, as the particle moved through a displacement **d** = (2.00 m)**i** - (4.00 m)**j** + (3.00 m)**k**. The change in the particle's kinetic energy is +30.0 J. What is the angle between the force vector and the displacement vector?

(A) 12.1^{o}	(B) 16.8^{o}	(C) 21.9^{o}	(D) 46.1^{o}	(E) 62.3^{o}

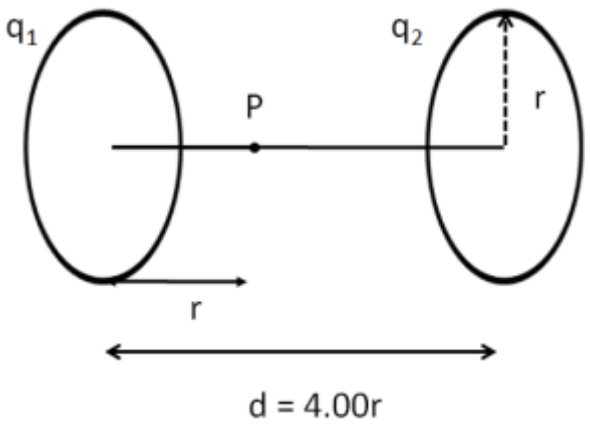
A2

If a metal conductor has a charge -1.45×10^{-7} C, how many excess electrons are there on it?

(A) 1.44×10^{-3}	(B) 2.40×10^{8}	(C) 9.05×10^{11}	(D) 8.31×10^{13}	(E) 1.05×10^{18}

A3

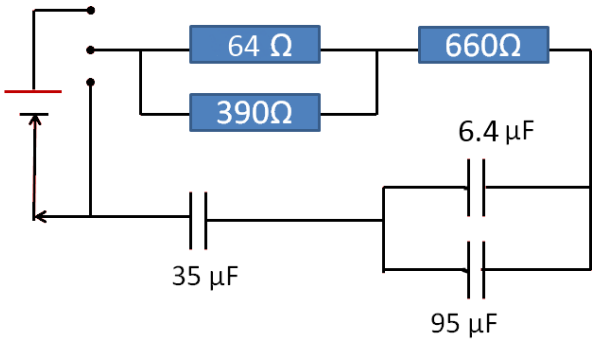
The figure shows two parallel non-conducting rings with their central axes along a common line. Ring 1 has a uniform charge q_1 and ring 2 has a uniform charge q_2. Both disks have a radius R, and the separation between the disks is 4R. The net electric field is zero at point P, which is R away from disk 1 and 3R from disk 2. What is the charge ratio q_1/q_2?



(A) 0.268	(B) 0.333	(C) 0.500	(D) 0.750	(E) 1.00

A4

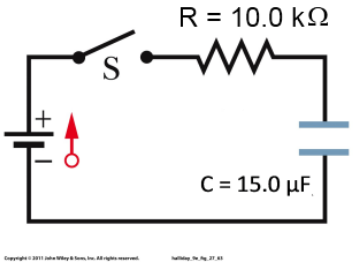
What is the time constant of this RC circuit?



(A) 26 µs	(B) 19 ms	(C) 1.2 s	(D) 11 s	(E) 230 s

A5

The switch S in the circuit pictured on the right is closed at t = 0 and the uncharged capacitor (C = 15.0 µF) starts to charge. At what point does the potential across the resistor (R = 10.0 kΩ) equal that of the capacitor?



(A) 525 µs	(B) 950 µs	(C) 0.100 ms	(D) 0.208 ms	(E) 0.350 ms

A6

A solenoid of length 15 cm, and with 45 turns, has a current of 1.25 amps flowing in it. What is the magnitude of the magnetic field inside the solenoid?

(A) 1.0×10^{-5} T	(B) 1.2×10^{-4} T	(C) 3.8×10^{-3} T	(D) 7.0×10^{-3} T	(E) 9.5×10^{-2} T

A7

A coil is connected in series with a 10.0 kΩ resistor. An ideal 50.0V battery is connected across the two devices, and the current reaches 2.00 mA after 5.00 milliseconds. Find the inductance of the coil.

(A) 97.9 H	(B) 108 H	(C) 979 H	(D) 2.61×10^{3} H	(E) 2.61×10^{6} H

A8

In an oscillating LC circuit with L = 65 mH and C = 4.0μF. The current is initially a maximum. How long will it take before the capacitor is fully charged for the first time?

(A) 7.1×10^{-7} s	(B) 2.6×10^{-6} s	(C) 4.0×10^{-5} s	(D) 6.4×10^{-4} s	(E) 8.0×10^{-4} s

Section B: Longer Questions

B1

23.31 Two long, charged, thin-walled, concentric, cylindrical shells have radii of 3.0 cm and 6.0 cm. The charge per unit length is 5.0×10^{-6} C/m^2 on the inner cylinder, and -7.0×10^{-6} C/m^2 on the outer cylinder.

(a) Calculate the magnitude and direction of the electric field at radial distance r = 4.0 cm (5 marks)

(b) Calculate the magnitude and direction of the electric field at radial distance r = 8.0 cm (5 marks)

B2

The electric potential in a region of space is given by the equation:

$$V = (2.0\ \text{V/m}^2)x^2 + (1.5\ \text{V/m})x - (3.0\ \text{V/m})y + (4.0\ \text{V/m}^2)z^2$$

(a) Find the equation for the electric field in this region of space (7 marks)

(b) Find the electric field at the point (3.0 m, 2.0 m, 1.5 m). (3marks)

B3

A 2.0 μF capacitor and a 4.0 μF capacitor are connected in parallel across a 240 V potential difference. The 4.0 μF capacitor has a parallel plate configuration, with a surface area of 110 cm^2, and a dielectric material (paper) between the plates with κ = 3.5

(a) Calculate the total charge stored on the capacitors (3 marks)

(b) Calculate the total energy stored in the capacitors (3 marks)

(c) Calculate the spacing between the plates in the 4.0 μF capacitor. (4 marks)

B4

An electrical cable consists of 125 identical strands of copper wire, each with a resistance of 265 mΩ. The same potential difference is applied between the ends of all the strands and results in a total current of 65.0 mA

(a) What is the current in each strand of wire?

(b) What is the applied potential difference?

(c) What is the resistance of the cable?

(d) How much power is dissipated in the cable?

B5

A proton (mass 1.67×10^{-27} kg) is travelling through uniform magnetic and electric fields. The electric field is (4.00 V/m)**k** and the magnetic field is **B** = (-2.50 mT)**i**. If the velocity of the proton is (3450 m/s)**k** , then using unit vector notation, calculate

(a) The electric force on the proton *(3marks)*

(b) The magnetic force on the proton *(4 marks)*

(c) The net acceleration on the proton *(3 marks)*