UACE Physics Paper

Competence Based Curriculum

2026

Time : 3 Hours

Instructions: This paper consists of **four** sections.

Choose **one** number from **each section.**

Where necessary, use the following list of constants:

Electron charge = 1.6 × 10^-19 C

Electron mass = 9.1 × 10^-31 kg

Coulomb constant, k = 9 x 10^9 Nm^2/C^2

Speed of light, c = 3.0 × 10^8 m/s

Acceleration due to gravity, g = 9.81 m/s^2

Stefan's constant = 5.6 × 10^-8 $W/m^2/K^4$

Temperature coefficient of resistance of nichrome = 2 x 10^-4 /K

Section A

1. While wiring a certain factory, an electrical engineer decides to connect a circuit for an electric heater of metals to a 240V supply with an average current of 4.17A. The electric heater will contain a nichrome wire whose resistance is 50.9Ω at 20.0ºC. Calculate the steady temperature reached by the nichrome wire.

2. Inside a particle accelerator, an electron is subjected to a force that moves it from rest to a speed 90% the speed of light over a distance of 1 km. Calculate the magnitude of positive charge that is able to do this and the potential difference applied onto on the electron.

Section B

3. A footballer is training to pass a ball to his team mate moving in his direction at a speed of 5 m/s. Calculate the speed at which he should hit the ball if the distance between him and his team mate is initially 50m and he kicks the ball at an angle of 60º.

4. A ballistics camp decide to use a ballistic pendulum by firing the bullet of mass 100g from a certain gun weighing 1kg, into a wooden block of mass 2kg attached to a string of length 4m, and the block rises by a height of 1m.

Task:

a) Calculate the speed of the bullet.

b) Calculate the approximate energy released by the gun powder neglecting energy lost as heat and sound.

Section C

5. An X-ray machine is being used to investigate crystal structure. A monochromatic beam of its X-rays of wavelength 2 x 10^-10 m is incident on a set of cubic planes in the potassium chloride crystal, and first order diffraction is observed at glancing angle of 18.5º

Task:

(a) Calculate the interatomic spacing of potassium chloride.

(b) Calculate the density of potassium chloride if it's relative molecular mass is 75.5 g.

Section D

6. A tuning fork of frequency 850 Hz is struck and brought close to the mouth of a flute, which behaves like an open pipe. The sound from the flute becomes unusually loud, indicating resonance. Given the flute is vibrating in its first overtone, the length of the flute is 0.38 m, and the end correction is 0.012 m;

Task: Determine the speed of sound in air.

7. A concentrated solar power (CSP) plant generates electricity using the sun's heat. They have placed a highly polished parabolic mirror of radius 10m to face the sun with an average solar constant of 1300W/m². The sunlight is then concentrated onto a blackened metal sphere of radius 20cm through which water will be passed to turn into hot steam that will drive a turbine.

Task : Determine the temperature reached by the blackened metal sphere.