Nanoelectronics Workshop 1

15:00-16:00 on Friday, 20/01/2023 (LFA 204X)

Handed in by 12:00 on Thursday, 02/02/2023 via VLE

Note: 12.5% of Final Mark (50% from Workshops and 50% from Final Examination)

Feedback:

In general, all the questions were answered well. There are some minor mistakes in significant figures and units in Questions 1 and 2. Please read the questions carefully. Please also check calculations, especially orders and substitution.

For Question 2(1)(d), a full mark is given for any answers which discussed the energy of the beam. Note that all the beams can be used for imaging in this case. For most of nanoelectronic devices, X-ray is commonly used for their characterisation.

In Question 3, Bohr's radius needs to be obtained using the following relationship:

The total energy of an electron in the Rutherford Hydrogen model:

$$E = (\text{kinetic energy}) + (\text{potential energy})$$
$$= \frac{1}{2}mv^2 - \frac{1}{4\pi\varepsilon_0}\frac{q^2}{r} \quad ,$$

Along the radius direction, the balance of force is

$$m\frac{v^2}{r} = \frac{q^2}{4\pi\varepsilon_0 r^2} \qquad \text{(rotational motion: } F = m\frac{v^2}{r}\text{)}$$

By comparing the above two equations, 2 × (kinetic energy) = (potential energy).

Then, you can simplify the energy determination as stated in the model answer.