

Name of the Student: _____

Max. Marks : 25 Marks

Time : 25 Minutes

Q1.

(a) A student made measurements to determine if some gold coins were made from pure gold. The coins that were available to the student are shown below.



(Source: © Bjoern Wylezich/Shutterstock)

The student used digital calipers to measure the thickness t and the diameter d of one of the coins.

(i) Calculate the volume V of the coin, and the percentage uncertainty in V .

$$t = 1.54 \text{ mm}$$

$$d = 22.16 \text{ mm}$$

(7)

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$$V = \text{.....}$$

$$\text{Percentage uncertainty in } V = \text{.....}$$

(ii) The student measured the mass of the coin using an electronic balance.

The balance had a resolution of 0.1 g.

Assess whether the coin could be made from pure gold.

$$\text{density of pure gold} = 1.93 \times 10^4 \text{ kg m}^{-3}$$

$$\text{mass of coin} = 11.2 \text{ g}$$

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(b) The student's experimental method could have been improved.

Explain two changes the student could have made to the experimental method.

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(Total for question = 15 marks)

Q2.

In 2014 the Rosetta spacecraft reached the comet Churyumov-Gerasimenko.
Rosetta went into orbit around the comet.

The following table gives some data for the comet.

Mass / kg	1.0×10^{13}
Density / kg m⁻³	470

The comet is irregular in shape but can be modelled as a spherical object.

(a) Show that a sphere with this mass and density has a radius of about 1700 m.

(3)

(b) Calculate the gravitational field strength at the surface of the comet.

(2)

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Gravitational field strength =

(c) A probe was sent from the Rosetta spacecraft to land on the comet.
The probe bounced off the surface of the comet and took 1 hour and 50 minutes to return to the surface again.

Calculate the height above the surface of the comet that the probe would have reached. Assume that the acceleration of the probe is constant with the magnitude calculated in (b).

(2)

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Height =

(d) Explain, using gravitational field theory, how the actual height reached would compare with the value calculated in part (c).

You may assume there are no resistive forces such as air resistance.

(3)

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(Total for question = 10 marks)