**Scenario-based questions: mark scheme**

**Scenario-based question 1**

Imagine you are a laboratory technician working in a medical laboratory. You are tasked with adjusting the pH of a new drug formulation to 7.4.

You have unknowingly been using an uncalibrated pH meter.

Explain two potential consequences to the medical laboratory of using an uncalibrated pH meter in this process.

AO2 = 4 marks

Award **one** mark for each potential consequence up to **maximum** of **two** marks, and **one** mark for each linked explanation of how that will affect the medical laboratory, up to a **maximum** of **two**.

Examples could include:

Incorrect calibration could lead to:

* incorrect calibration could lead to an inaccurate/unreliable pH being recorded and therefore the drug formulation not being adjusted to pH 7.4 as required (1) – the medical laboratory could no longer be trusted in the industry and could lose work (1);
* incorrect calibration could lead to the pH meter being damaged/requiring replacement sooner than necessary which will cost the medical laboratory money to replace (1); this will reduce profits and potentially delay the adjustment of the new drug formulation pH/completion of the project (1);
* incorrect calibration could lead to the drug formulation not having the correct pH and therefore not meeting legal requirements (1); this will prevent the regulatory agency from allowing the drug to be sold and lead to fines/legal action against the laboratory (1);
* altering the drug’s stability/reactivity/effectiveness (1), potentially costing the medical laboratory more money or issues with quality-assurance processes and correcting their errors later in the process (1).

Accept any other suitable response.

**Scenario-based question 2**

During the third step of the production cycle, a balance is used to measure out six portions of 75 kg of a chemical feedstock, which costs the company £13.55 per kilogram.

If this balance is under-reading the mass by 1.25%, how much money is being wasted per production cycle?

AO2 = 3 marks

Award **two** marks for the correct calculation and **one** mark for the correct answer, up to a **maximum** of **three** marks.

75 kg x (1.25/100) = 0.9375 kg wasted per portion (1)

0.9375 x 6 portions = 5.625 kg wasted over 6 portions (1)

5.625 kg x £13.55 kg-1 = £76.22 wasted per cycle (1)

**Scenario-based question 3**

A new anticancer drug needs to be prepared by being vaporised and then adsorbed onto nanoparticle surfaces, which act as carriers.

1500 μL of a 0.001 g/μL solution (per gram of nanoparticle) needs to be transferred into the vaporiser using 100 μL aliquots. The threshold of delivery for the drug to be effective is a minimum of 1.4 g of drug (per gram of nanoparticle).

A research lab is using a mechanical pipette to create the solution. The pipette has not been recently calibrated and when used to deliver 100 μL, it delivers only 93 μL per aliquot.

Explain why there will not be enough drug loaded (per gram of nanoparticles) to meet the threshold.

**If there is time**, calculate the percentage error in the measurement of one aliquot of 100 μL using this uncalibrated pipette.

AO2 = 3 marks

Award **one** mark for the correct calculation, **one** mark for the correct answer and **one** mark for an explanation, up to a **maximum** of **three** marks.

93 μL x 0.001 g/μL = 0.093 g of drug per aliquot (1)

0.093 g x 15 = 1.395 g of drug per 15 aliquots (1)

There will not be enough drug in the vaporiser to meet the threshold for drug loading, as the uncalibrated pipette will only transfer a mass of 1.395 g of drug into the vaporiser (1).

-------

**Uncertainty:** 100−93 = 7. 7/100 x 100 = 7%

Each aliquot has a 7% error.