

## CTSI Professional Competency Framework (CPCF) written examination

### Unit 4: Weights and Measures

September 2021

### Guidance for this examination

Please ensure that you indicate, by ticking (✓) the relevant box on the front of your examination booklet, the law viewpoint from which you will be answering: English, Scottish or Welsh.

The examiners may expect candidates to show knowledge of legislation which is in place but not in force (i.e. has been enacted) and regulations which have been made but are not yet in force, if they are directly relevant to the subject-matter of the examination.

### Examination structure

There are two sections to the examination paper:

**Section A** Consists of six questions.  
Candidates should attempt to answer three questions.  
Total allocation of marks is 30 marks.  
Suggested time allocation is 30 minutes.

**Section B** Consists of four questions.  
Candidates should attempt to answer two questions.  
Total allocation of marks is 70 marks.  
Suggested time allocation is 90 minutes.

Total time allowed – two hours (plus ten minutes' reading time).

### Note:

The Weights and Measures paper is a **closed book**; no materials are permitted to be taken into the examination room.

*The examination paper has six pages, including this front sheet.*

**Exam:** Unit 4: Weights and Measures

**Exam cycle:** September 2021

**Date:** 15 September 2020

**Reading time:** 10 minutes

**Time:** 10:00 – 12:00

**Max:** 100 marks

**Section A**  
**Candidates should attempt to answer three questions -**  
**Total of 30 marks.**

1. Answer both parts:

(a) Briefly explain the operation of a strain gauge load cell referring to Ohms Law. (5 marks)

(b) What is the difference between an analogue load cell and a digital load cell?

Use diagrams, if relevant.

(5 marks)

(total: 10 marks)

2. Answer both parts:

(a) For the purposes of Great Britain (GB), what is an authorised representative and what tasks can they carry out? (6 marks)

(b) Give an example of how this may operate under The Non-automatic Weighing Instruments Regulations 2016. (4 marks)

(total: 10 marks)

3. Answer all parts:

(a) Briefly outline the requirements with respect to software identification in legal metrology. (4 marks)

(b) Explain the difference between a version number and a checksum. (3 marks)

(c) Give an example of the types of instruments where you would find both. (3 marks)

(total: 10 marks)

**Section A continues over the page.**

4. Answer both parts:

- (a) What are the main requirements for weights outlined in OIML R111 (20014)? (7 marks)
- (b) What category of weights would you use to initially conformity assess a weighing instrument used for commercial transactions by a jeweller? (3 marks)
- (total: 10 marks)

5. Answer both parts:

- (a) What is a pulser and what is a calculator on a liquid fuel measuring instrument? (6 marks)
- (b) Explain briefly how they work and why they should be sealed. (4 marks)
- (total: 10 marks)

6. You have a weighing scale manufacturer in your area. Since the UK departure from the EU, they have noticed an increase in the number of requests for instruments that can weigh in imperial units. They would like to know if they could design and build an instrument that can be used for trade, and weigh in imperial units.

What advice would you give them? Explain your answer.

(10 marks)

**Section A total of 30 marks.**

**End of Section A.**

**Section B**  
**Candidates should attempt to answer two questions-**  
**Total of 70 marks.**

7. You are an Inspector of Weights and Measures working for a local weights and measures authority in Great Britain (GB) as a result of budget cuts, the authority is not an approved body.

The authority is carrying out a project to check for the compliance of itinerant buyers and sellers of gold, silver and other precious metals with Weights and Measures Legislation.

You attend a local village hall to carry out an inspection of one of these traders and discover that he is using a non-automatic weighing instrument. You inspect the instrument and are pleased to see that it has a CE mark and the other relevant legal metrology markings that show compliance with The Non-Automatic Weighing Instrument Regulations 2016 (as amended).

- (a) List seven of the markings, besides the CE mark, that you may expect to see on the instrument. (7 marks)
- (b) What advice would you give him if he wished to use the instrument in your authority next year? (3 marks)
- (c) Explain, in detail, the metrological assessments and tests you would carry out to ensure that the instrument is compliant with The Non-Automatic Weighing Instruments Regulations 2016 (as amended) and how you would calculate the errors. (The instrument does not have an auxiliary indication.)  
  
What would the maximum allowable errors be? (15 marks)
- (d) What actions could you take immediately regarding your findings? Explain your answer. (5 marks)
- (e) What would the trader need to do if he wished to continue using the instrument? (5 marks)
- (total: 35 marks)

**Section B continues over the page.**

8. You are out doing inspections at a local scrapyards, and you notice a liquid fuel measuring instrument on the site; a customer is filling a jerry can, which is then paid for. The instrument is an old dispenser and is not networked to any other devices. It is both a diesel dispenser and an unleaded dispenser. The instrument has a data plate which shows the date of manufacture as 1989, but it bears no other metrology markings and shows no evidence of ever having been verified.

(a) Draw a block diagram of the major parts of the liquid fuel dispenser and indicate the direction of flow of the fuel. (11 marks)

(b) What advice would you give the owner of the liquid fuel measuring instrument regarding the absence of the verification marks and sealing? (6 marks)

(c) (i) The owner decides to purchase a new liquid fuel measuring instrument. What physical tests would you undertake and what errors would you apply? (6 marks)

(ii) What legal metrology marks would you expect to see on the new instrument, to ensure that it is fully compliant with the legislation? The new instrument is verified in February 2022. (6 marks)

(d) The owner of the liquid fuel measuring instrument would like to connect it to his new computer system and print invoices for any fuel sold. Would this be possible? Explain your answer. (6 marks)

(total: 35 marks)

9. A local consumer, Mr White, visits a local discount store, Orange Discount Products, to buy some washing powder. He buys a one-kilogram box of washing powder.

When he gets home, he opens it and notices that the box does not appear to be full. He telephones Orange Discount Products to complain, but the owner, Mr Blue, informs him that the manufacturer seals the boxes at the point of production, and it is nothing to do with him. Unhappy with Mr Blue's response, Mr White decides to complain to you as his local authority Trading Standards Officer and Inspector of Weights and Measures.

Mr White subsequently visits your office with the opened, but unused, box of washing powder. You determine that the gross weight of the box of washing powder is 965grams, with the net weight of the powder being 955 grams.

You decide to visit Orange Discount Products to make further enquiries. Whilst in the store, you find five identical boxes to Mr White's complaint item on display. You weigh these remaining boxes in the store. Although the gross weight of four of these is over 1,020 grams, one of them weighs 970 grams.

You observe that all the boxes are red in colour and have a 5mm high orange e-mark on the front. On the rear of the box is a marking stating "1 Kilo." and "Packed by Blissfully Bubbly". An address in your area for Blissfully Bubbly is marked on the box. The lettering is in 3mm high black writing.

**Question 9 continues over the page.**

You subsequently visit Blissfully Bubbly and discover that it is a small-sized producer of household washing powder; it has only recently opened in your area. The owner of Blissfully Bubbly is Mr John Brown.

John Brown informs you that Blissfully Bubbly only packs washing powder in one-kilogram boxes, using two separate packing lines. Overall, 200 boxes are produced on average each hour. Mr. Brown further advises that he personally carries out weight checks on his production, twice per day, but makes no records. He also confirms that any which are below the nominal quantity are “topped-up to the very top of the box”, but they are not always reweighed.

You carry out a reference test and, although the average weight of the sample is 1,001 grams, five of the boxes have a net weight of 965 grams. Blissfully Bubbly uses a 25-kilogram non-automatic weighing instrument to check the boxes. On examination, you cannot find any information relating to any type of approval certificate or any other required conformity assessment markings. The instrument is, however, accurate.

Apply the provisions of Part IV of the Weights and Measures Act 1985 (as amended), and The Weights and Measures (Packaged Goods) Regulations 2006, to the above scenario. In doing so, identify potential offences and defences.

(35 marks)

10. You have been approached by a local business in your area that would like to place material measures of length, and import material measures of length for the UK market. He has manufactured measures of length previously, about ten years ago, and he still has a number of these available to be sold in his factory shop. These measures of length bear a CE mark, an M mark, and a notified body number. He would like to sell the imported instruments on the market in the UK, and have them produced in France. He would like advice on the procedures that would enable him to supply these instruments in the UK, under The Measuring Instruments Regulations 2016 (as amended).

(a) Can they legally supply the instruments that he has in the store in the UK? Explain your reasons.

(7 marks)

(b) What advice would you give them regarding the conformity assessment procedures necessary to place the newly manufactured instruments on the market in the Great Britain (GB) and who should carry these out?

(11 marks)

(c) What is the significance of the OIML Document R35? What are the three categories of measure and what are the three different type of error that would be applied to a material measure of length?

Briefly explain how you would undertake a verification.

(9 marks)

(d) Can the material measure of length be conformity assessed in both metric and imperial units for the GB market? Briefly explain your answer.

(8 marks)

(total: 35 marks)

**Section B total of 70 marks.**

**END OF EXAMINATION PAPER.**