

# Numeracy In Practice

Building Workplace Numeracy Proficiency  
and Training Skills of VET Practitioners



This Snapshot relates to Question 5 from the Numeracy Proficiency Assessment Tool – Process Manufacturing Industry. It is designed to be read in conjunction with explanatory information provided in the Guide.

## Calculating Quantities

Many jobs require workers to calculate quantities, for example:

- Kitchen hands preparing a recipe
- Painters preparing a coating mix
- Laboratory technicians preparing samples for testing
- Farmers preparing sprays

This example is a quantity calculation of a formulation with both solids and liquids. Examples of formulations in the workplace include mixtures of solids, liquids and/or gases. They range from large mixes weighed in tons to small mixes weighed in milligrams or micrograms.

Workers responsible for quantity calculations require complementary skills, for example skills to:

- Work safely
- Follow workplace instructions
- Meet quality requirements
- Work cooperatively
- Meet deadlines
- Identify and report problems
- Explain quantity calculations to other workers, supervisors or customers

## THE QUESTION

An operator at a gel coating operation is preparing a mix of gel coat using a batch formulation. The batch is prepared by measuring the ingredients by weight and adding them to a drum ready for mixing.

The batch formulation includes both liquids and solids. The liquids are specified by volume (litres) and the solids are specified by weight (grams). To add the liquids the operator must use Specific Gravity\* to convert the volumes to weights.

\*Specific Gravity (SG) is the heaviness of a substance compared to that of water, and it is expressed without units. The SG of water is 1 where 1 litre of water is equal to 1 kilogram.



Batch Formulation		
Ingredient	Amount	Specific Gravity
Ingredient A	1500 grams	1.36
Ingredient B	850 grams	1.22
Ingredient C	15 litres	0.80
Ingredient D	2.5 litres	0.72
Ingredient E	2 litres	0.95

What is the total weight of the batch in grams?

## ACSF NUMERACY LEVEL

This question requires skills associated with calculating quantities.

The content area of calculating quantities is described as part of indicator .10 at level 4 in the focus area *Mathematic knowledge and skills: measurement and geometry* and the focus area *Problem solving processes including estimating and reflecting*.

Working through this PD resource places you in the role of the learner.

This question requires level 4 indicator .09 skills to read and interpret the question.

The question also requires level 4 indicator .11 skills to communicate the answer.

This question maps to ACSF numeracy level 4.

## WHAT THE QUESTION IS ASKING

The mathematical information embedded in the question must be identified and interpreted before the problem can be solved.

The first paragraph and the photograph contain mathematical information about measuring quantities. They indicate that measurement is by weight using a batch formulation as the specification. Knowledge of measuring quantities is needed to interpret this information.

The second paragraph explains that the quantities of liquids and solids have been specified in the batch formulation differently. It also explains that liquid volume quantities must be converted to weights using Specific Gravity. Knowledge of quantity conversions is needed to interpret this information.

The third paragraph defines Specific Gravity and contains the mathematical information needed to develop the conversion formula. Knowledge of weights and volumes, developing formulas and converting between weights and volumes is needed to interpret this information.

The table contains mathematical information about quantities. It shows the amount and Specific Gravity for each ingredient. The amounts in grams (Ingredients A and B) are specified by weight and need no conversion. The amounts specified in litres (Ingredients C, D and E) are specified by volume and must be converted to weight in grams. Knowledge of quantity specifications by volume and weight is needed to interpret this table.

The last sentence contains mathematical information about the problem to be solved. It asks for the total weight and specifies that the answer must be represented in grams. Knowledge of calculating totals and metric units of measurement is needed to interpret this information.

## HOW TO SOLVE THE PROBLEM

There is more than one way to answer this question. One possible option is shown.

- Identify what needs to be converted

*Identify 'amounts' column*

*Identify amounts specified by weight (Ingredients A and B). These need no conversion*

*Identify amounts specified by volume (Ingredients C, D and E). These need conversion to weight in grams*

- Develop conversion formula

*SG of water is 1 where 1 litre of water is equal to 1 kilogram*

*Weight (water)/volume (water) = 1*

*Weight/volume = SG*

*Transpose formula to solve for weight by multiplying both sides by volume*

*Weight = SG x volume*

A handwritten calculation showing the conversion of ingredients A through E to grams. Ingredient A is 1500g, B is 850g, C is 15L x 0.8 = 12kg = 12000g, D is 2.5L x 0.72 = 1.8kg = 1800g, and E is 2L x 0.95 = 1.9kg = 1900g. The total weight is 18,050g.

A	1500g.
B	850g.
C	15L x 0.8 = 12kg = 12000g.
D	2.5L x 0.72 = 1.8kg = 1800g
E	2L x 0.95 = 1.9kg = 1900g
<hr/>	
18,050g.	

An example of a correct answer

- Convert volumes to weights

*Use formula and data provided in the table*

$$\text{Ingredient C weight} = SG \times \text{volume} = 0.8 \times 15 = 12 \text{ kg}$$

$$\text{Ingredient D weight} = SG \times \text{volume} = 0.72 \times 2.5 = 1.8 \text{ kg}$$

$$\text{Ingredient E weight} = SG \times \text{volume} = 0.95 \times 2 = 1.9 \text{ kg}$$

- Do metric conversion

$$1 \text{ kilogram} = 1000 \text{ grams}$$

$$\text{Ingredient C } 12 \text{ kg} \times 1000 = 12\,000 \text{ grams}$$

$$\text{Ingredient D } 1.8 \text{ kg} \times 1000 = 1800 \text{ grams}$$

$$\text{Ingredient E } 1.9 \text{ kg} \times 1000 = 1900 \text{ grams}$$

- Find total weight

*Calculate sum of all the ingredients in grams*

$$\begin{aligned} \text{Total} &= \text{Ingredient A} + \text{Ingredient B} + \text{Ingredient C} + \text{Ingredient D} + \text{Ingredient E} \\ &= 1500 \text{ g} + 850 \text{ g} + 12\,000 \text{ g} + 1800 \text{ g} + 1900 \text{ g} = 18\,050 \text{ g} \end{aligned}$$

## HOW TO CHECK THE ANSWER

Check the procedure to ensure that all tasks needed to solve the problem have been correctly identified and followed. For example, check that only the volumes have been converted. Check that the formulas for the SG conversion and the kilograms to grams conversion are correct.

Check that the answer is reasonable. For example, imagine the liquid ingredients in the original table are water with  $SG = 1$ . Multiply the amounts by 1000 to convert to grams. Calculate the sum of the ingredients. Compare this result to the answer. If it is close but slightly bigger, then the answer is reasonable.

## HOW TO COMMUNICATE THE ANSWER

Record the answer providing the result and the unit of measure. The most technically correct answer is 18 050 g.

## ACSF ASSESSMENT DECISIONS

A Credit is applied to the following answers:

1. 18 050 g or 18 050 grams
2. 18 050 (the question provided the unit of measurement and therefore the answer can stand alone without a unit of measurement)
3. 18 050 gm, 18 050 gms (an unconventional unit abbreviation, but the benefit of the doubt given because the amount was calculated correctly)
4. 18.05 kg or 18.05 kilograms (an incorrect representation, but the benefit of the doubt given because the amount was calculated correctly)

## MEETING WORKPLACE EXPECTATIONS

In most workplaces the worker is expected to record the correct answer in accordance with workplace requirements. This is consistent with the first response above.

Response 2 may be acceptable depending on workplace requirements. For example, if a table used for recording workplace data included 'g' or 'grams' in the column heading, the unit of measurement may not be required in the answer.

Response 3 may be acceptable depending on workplace requirements. The standard international abbreviation for grams is 'g' and other abbreviations can lead to confusion and errors if not understood by other workers.

Response 4 is mathematically correct but represented in kilograms, not grams. This is a problem if the answer is used by another worker not skilled in metric conversions. This is unacceptable in the workplace.

Incorrect answers may cause problems that impact productivity, quality and safety. This is unacceptable in the workplace.

## ANALYSING RESPONSES TO IDENTIFY SKILL GAPS

Common incorrect responses use the incorrect procedure, incorrect SG conversions, incorrect metric unit conversions or a combination of these.

Common procedural errors are:

- Calculating the total without doing the SG conversion
- Calculating the total without doing the metric conversion
- Calculating the total of the SGs and then multiplying by 1000

Common incorrect SG conversions are:

- Converting the weights to volumes instead of the volumes to weights
- Calculating the SG conversions for all the ingredients instead of only the liquids
- Using the wrong conversion formula and dividing instead of multiplying the volume by the SG

Common incorrect metric unit conversions are:

- Using a conversion rate of 10 000 instead of 1000 to convert from kilograms to grams
- Multiplying 12 kg x 1000 and getting the answer of 1200 instead of 12 000

These errors suggest support is needed for level 4 indicator .10 in relation to selecting and applying the appropriate mathematical and problem solving strategies.

They also suggest support is needed at this level for indicator .09 to correctly identify and interpret the mathematical information in the question.

Further investigation is needed to identify the exact nature of the numeracy skill gap.

## IMPLICATIONS FOR TRAINING DELIVERY

Encourage the learner to talk about calculating and converting quantities at home and at work.

Talk about:

- Quantities they must calculate and convert
- What they are used for
- Why they are important
- How they are used
- What calculations are needed
- How and where the outcome is reported
- How and where it is recorded

**Working through this PD resource will support you to confirm and strengthen your own numeracy skills.**

Check learner performance against workplace requirements to identify learner needs. The learner may:

- Need support in one or more of the numeracy indicators
- Be suffering from maths anxiety
- Lack the complementary skills needed to perform the task, such as a correct understanding of the workplace requirements for calculating and converting quantities

Use a range of teaching strategies, such as:

- Ask the learner to show their work and explain the working out
- Draw on what the learner already knows and challenge them
- Sequence the material according to the learners' individual needs. For example, they may be overwhelmed at the amount of information provided in the question
- Incorporate a range of quantity calculations and workplace conditions. Include examples using different batch formulations
- Ask questions to extend the learner, such as:
  - How would you explain to someone else what a batch formulation is?
  - How would you explain to someone else why the conversions are necessary?
  - How do you recognise a correct answer?
  - How do you recognise and incorrect answer?
- Mix up questions that do and do not include conversions and that contain different units of measurement for additional challenge
- Provide opportunities for practice without fear of failure and with time for reflection
- During training, work with data gathered from the workplace and discuss the results
- Have the learner weigh 1 litre quantities of the liquid ingredients and calculate the SG from the raw data to create more meaning
- Outside training, encourage the learner to remove avoidance strategies, such as relying on another team member to undertake the calculations
- Assign a workplace buddy or mentor
- Ask learners to reflect on what they have learnt, the challenges encountered and how they were overcome



## PROFESSIONAL DEVELOPMENT LEARNING STRATEGIES

Build your own skills:

- Identify examples of typical quantity calculations and conversions found in the workplace
- Take a tour of the workplace and talk to people about quantity calculations and conversions, including:
  - What they are used for
  - Why they are important
  - Who uses them
  - How they are used
  - How and where they are reported
  - How and where they are recorded
- Find examples of typical quantity calculations found in the home, such as arranging a takeaway food order or purchasing supplies to paint the house
- Practise quantity calculations and conversions found in the workplace, home or on the internet
- Check your answers with a trusted peer or mentor
- Ask a trusted peer or mentor to challenge you to extend your skills

**Working through this PD resource will support you to confirm and strengthen your numeracy teaching skills.**

## ABOUT THIS RESOURCE

*Numeracy in Practice* is a professional development resource to support the development of VET practitioner numeracy proficiency skills and numeracy training skills.

It has been developed in response to a National Centre for Vocational Education and Research (NCVER) report titled [Seeking the N in LLN](#). This report found that there may be a need to increase the capacity of the VET workforce to meet the numeracy skills needs of existing workers. A copy of the full report is available for download at [www.ncver.edu.au](http://www.ncver.edu.au).

[Numeracy in Practice: Building Workplace Numeracy Proficiency and Training Skills of VET Practitioners](#) includes:

- A Guide with professional development activities
- A Numeracy Professional Assessment Tool – Process Manufacturing Industry
- Six Snapshots exploring different workplace numeracy skills

Topics covered in the Snapshots include:

- Reading instruments
- Using ratios and metric conversions
- Using rates and performing time calculations
- Measuring lengths
- Calculating quantities
- Reading specifications

VET practitioners interested in increasing their awareness of numeracy skills in the workplace may also like to access the companion resource [\*Numeracy in Focus: Building VET Practitioner Awareness of Numeracy in the Workplace\*](#).

*Numeracy in Practice* and *Numeracy in Focus* are available for download from the WELL practitioners' website at [www.wellpractitioners.com.au](http://www.wellpractitioners.com.au).

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