Refreshing drinks

Assessment description	Category
Students apply understanding of ratios, fractions and percentages to solve problems when mixing ingredients for fruity drinks.	Written
	Technique
	Supervised assessment
Context for assessment	**Alignment**
The assessment gathers evidence about how well students demonstrate their Understanding, Fluency and Problem solving when using the concept of ratio to represent ratios in a variety of ways, to adapt a recipe for a larger or smaller quantity, and to communicate the mathematical steps involved. This assessment can be used with the QSA Australian Curriculum resource titled *Year 7 unit overview — Mathematics exemplar* (Recipe ratios), available at: www.qsa.qld.edu.au/yr7-maths-resources.html	*Australian Curriculum v5.1*, Year 7 Mathematics Australian Curriculum content and achievement standard ACARA — Australian Curriculum, Assessment and Reporting Authority www.australiancurriculum.edu.au Year 7 Mathematics standard elaborations www.qsa.qld.edu.au/yr7-maths-resources.html
	Connections
	This assessment can be used with the QSA Australian Curriculum resource titled *Year 7 unit overview — Mathematics exemplar* available at: www.qsa.qld.edu.au/yr7-maths-resources.html
	Definitions
	Refer to the Australian Curriculum definitions at www.australiancurriculum.edu.au and the Year 7 Mathematics standards elaborations glossary at www.qsa.qld.edu.au/yr7-maths-resources.html
In this assessment	

- Teacher guidelines
- Task-specific standards — continua
- Task-specific standards — matrix
- Model response
- Student booklet

Teacher guidelines

Identify curriculum

Content descriptions to be taught
Number and algebra
Real numbers • Connect fractions, decimals and percentages and carry out simple conversions ACMNA157 • Recognise and solve problems involving simple ratios ACMNA173 • Compare fractions using equivalence. Locate and represent positive and negative fractions and mixed numbers on a number line ACMNA152 • Solve problems involving addition and subtraction of fractions, including those with unrelated denominators ACMNA153 • Multiply and divide fractions and decimals using efficient written strategies and digital technologies • Find percentages of quantities and express one quantity as a percentage of another, with and without digital technologies ACMNA158
General capabilities (GCs) and cross-curriculum priorities (CCPs) This assessment may provide opportunities to engage with the following GCs and CCPs. Refer also to the Resources tab on the Mathematics curriculum hub: www.qsa.qld.edu.au/yr7-maths-resources.html

📖 **Literacy**
 	
    🔢 **Numeracy**
 	
    🖥️ **ICT capability**
 	
    ⚙️ **Critical and creative thinking**

Achievement standard
This assessment provides opportunities for students to demonstrate the following highlighted aspects.

By the end of Year 7, students solve problems involving the comparison, addition and subtraction of integers. They make the connections between whole numbers and index notation and the relationship between perfect squares and square roots. They solve problems involving percentages and all four operations with fractions and decimals. They compare the cost of items to make financial decisions. Students represent numbers using variables. They connect the laws and properties for numbers to algebra. They interpret simple linear representations and model authentic information. Students describe different views of three-dimensional objects. They represent transformations in the Cartesian plane. They solve simple numerical problems involving angles formed by a transversal crossing two parallel lines. Students identify issues involving the collection of continuous data. They describe the relationship between the median and mean in data displays.

Students use fractions, decimals and percentages, and their equivalences. They express one quantity as a fraction or percentage of another. Students solve simple linear equations and evaluate algebraic expressions after numerical substitution. They assign ordered pairs to given points on the Cartesian plane. Students use formulas for the area and perimeter of rectangles and calculate volumes of rectangular prisms. Students classify triangles and quadrilaterals. They name the types of angles formed by a transversal crossing parallel line. Students determine the sample space for simple experiments with equally likely outcomes and assign probabilities to those outcomes. They calculate mean, mode, median and range for data sets. They construct stem-and-leaf plots and dot-plots.

Source: ACARA, The Australian Curriculum v5.1, www.australiancurriculum.edu.au

Sequence learning

Suggested learning experiences

This assessment leads on from the learning experiences outlined in the QSA's Year 7 Mathematics unit overview. The knowledge, understanding and skills developed in the exemplar unit will prepare students to engage in this assessment:

- See unit overview — Mathematics exemplar www.qsa.qld.edu.au/yr7-maths-resources.html

Adjustments for needs of learners

To make adjustments, teachers refer to learning area content aligned to the student's chronological age, personalise learning by emphasising alternate levels of content, general capabilities or cross-curriculum priorities in relation to the chronological age learning area content. The emphasis placed on each area is informed by the student's current level of learning and their strengths, goals and interests. Advice on the process of curriculum adjustment for all students and in particular for those with disability, gifted and talented or for whom English is an additional language or dialect are addressed in *Australian Curriculum — Student Diversity* materials.

For information to support students with diverse learning needs, see:

- Queensland Studies Authority materials for supporting students with diverse learning needs www.qsa.qld.edu.au/10188.html
- Australian Curriculum Student Diversity www.australiancurriculum.edu.au/StudentDiversity/Overview
- The *Melbourne Declaration on Educational Goals for Young Australians* www.mceecdya.edu.au/mceecdya/melbourne_declaration,25979.html
- The *Disability Standards for Education* www.ag.gov.au.

Develop assessment

Preparing for the assessment

- Recognise commonalities and make connections between fractions, decimals, percentages and ratios, with and without digital technologies, e.g. interactive programs, websites.
- Describe relationships between quantities using ratios.
- Represent ratios in various ways, including fractions, decimals and percentages (see Appendix A: Background information for teachers).
- Explore the concept of equivalence, with and without digital technologies, e.g. hands-on resources.
- Select and use mathematical language associated with ratios.
- Find a simple fraction of a quantity where the result is a whole number, with and without digital technologies.
- Convert between different representations of ratios, e.g. fractions, decimals, percentages.
- Simplify fractions and ratios.
- Choose and carry out appropriate procedures to divide an amount into a given ratio or to increase and decrease different quantities in ratio, with and without digital technologies.
- Formulate, interpret and solve authentic ratio problems involving money, time and other measures, using fractions, decimals, or percentages, e.g. playdough recipes, best buys in supermarkets, the nature of traffic passing the school, food preferences, ratio of boys to girls in the class.
- Verify the reasonableness of solutions by checking that answers fit the questions using a variety of techniques, including applying existing strategies such as estimation and working backwards.
- Interpret ratio word problems.
- Apply an understanding of ratio.
- Explain the connection between ratios and everyday life, e.g. finances, recipes.
- Communicate solutions effectively using mathematical language and visual representations of ratios.
- Explain or justify strategies used to solve ratio problems.

Implementing

- Read questions aloud to the class to ensure literacy demands do not prevent students from providing evidence of their understanding and skills in mathematics.
- Clarify what is required in the assessment and the task-specific standards as needed.
- Supervise students and assist where appropriate.

Make judgments

When making judgments about the evidence in student responses to this assessment, teachers are advised to use the task-specific standards provided. The development of these task-specific standards has been informed by the Queensland Year 7 standard elaborations. See www.qsa.qld.edu.au/yr7-maths-resources.html.

The Queensland standard elaborations for Mathematics

The Queensland Year 7 standard elaborations for Mathematics is a resource to assist teachers to make consistent and comparable evidence-based A to E (or equivalent) judgments. It should be used in conjunction with the Australian Curriculum achievement standard and content descriptions for the relevant year level.

The Queensland Mathematics standard elaborations provide a basis for judging *how well* students have demonstrated what they know, understand and can do using the Australian Curriculum achievement standard.

The Australian Curriculum achievement standards dimensions of Understanding and Skills are used to organise the Queensland Mathematics standard elaborations. Understanding and Skills in Mathematics are organised as Understanding, Fluency, Problem solving and Reasoning.

The valued features of Mathematics drawn from the achievement standard and the content descriptions for Understanding, Fluency, Problem solving and Reasoning are organised as:

- Mathematical understandings
- Recall and use of facts, definitions, technologies and procedures
- Use of mathematical language, conventions and symbols
- Use of problem-solving approaches
- Modelling and representation
- Results and conclusions of investigations and inquiries
- Communication of mathematical thinking, choices and strategies.

Task-specific standards

Task-specific standards give teachers:

- a tool for directly matching the evidence of learning in the student response to the standards
- a focal point for discussing student responses
- a tool to help provide feedback to students.

Task-specific standards are not a checklist; rather they are a guide that:

- highlights the valued features that are being targeted in the assessment and the qualities that will inform the overall judgment
- specifies particular *targeted aspects* of the curriculum content and achievement standard
- aligns the valued feature, task-specific descriptor and assessment
- allows teachers to make consistent and comparable on-balance judgments about student work by matching the qualities of student responses with the descriptors
- clarifies the curriculum expectations for learning at each of the five grades (A–E or the early years equivalent)
- shows the connections between what students are expected to know and do, and how their responses will be judged and the qualities that will inform the overall judgment
- supports evidence-based discussions to help students gain a better understanding of how they can critique their own responses and achievements, and identify the qualities needed to improve
- encourages and provides the basis for conversations among teachers, students and parents/carers about the quality of student work and curriculum expectations and related standards.

Task-specific valued features

Task-specific valued features are the discrete aspects of the valued features of Mathematics targeted in a particular assessment and incorporated into the task-specific standards for that assessment. They are selected from the Queensland Mathematics standard elaborations valued features drawn from the Australian Curriculum achievement standard and content descriptions.

Task-specific valued features for this assessment		
The following table identifies the valued features for this assessment and makes explicit the understandings and skills that students will have the opportunity to demonstrate. This ensures that the alignment between what is taught, what is assessed and what is reported is clear.		
Australian Curriculum achievement standard dimensions	**Queensland standard elaborations valued features**	**Task-specific valued features**
Understanding & Skills	**Understanding and Fluency**	• Expressing quantities as ratios, fractions, and percentages. • Operating with fractions and percentages to solve ratio problems. • Using conventions to express quantities as ratios, fractions and percentages. Showing working and making use of units.
	Problem solving and Reasoning	• Applying problem-solving approaches to complex and unfamiliar situations involving ratios.

The task-specific standards for this assessment are provided in two models using the same task-specific valued features:

- a matrix

- a continua.

Matrix and continua

Task-specific standards can be prepared as a matrix or continua. Both the continua and the matrix:

- use the Queensland standard elaborations to develop task-specific descriptors to convey expected qualities in student work — A to E or equivalent

- highlight the same valued features from the Queensland standard elaborations that are being targeted in the assessment and the qualities that will inform the overall judgment

- incorporate the same task-specific valued features, i.e. make explicit the particular understanding or skills students have the opportunity to demonstrate for each selected valued feature

- provide a tool for directly matching the evidence of learning in the student response to the standards to make an on-balance judgment about student achievement

- assist teachers to make consistent and comparable evidence-based A to E or equivalent judgments.

Continua

The continua model of task-specific standards uses the dimensions of the Australian Curriculum achievement standard to organise task-specific valued features and standards as a number of reference points represented progressively along an A–E continuum. The task-specific valued features at each point are described holistically. The task-specific descriptors of the standard use the relevant degrees of quality described in the Queensland standard elaborations.

Teachers determine a position along each continuum that best matches the evidence in the students' responses to make an on-balance judgment about student achievement on the task.

The continua model is a tool for making an overall on-balance judgment about the assessment and for providing feedback on task specific valued features.

Matrix

The matrix model of task-specific standards uses the structure of the Queensland standard elaborations to organise the task-specific valued features and standards A to E. The task-specific descriptors of the standard described in the matrix model use the same degrees of quality described in the Queensland standard elaborations.

Teachers make a judgment about the task-specific descriptor in the A to E (or equivalent) cell of the matrix that best matches the evidence in the students' responses in order to make an on-balance judgment about how well the pattern of evidence meets the standard.

The matrix is a tool for making both overall on-balance judgments and analytic judgments about the assessment. Achievement in each valued feature of the Queensland standard elaboration targeted in the assessment can be recorded and feedback can be provided on the task-specific valued features.

Use feedback

Feedback to students	This assessment provides opportunities to give feedback to students on how well they: • demonstrate understanding of the concept of ratio • demonstrate understanding of equivalent fractions and ratios • convert ratios to fractions and percentages • use fractions and/or percentages to solve ratio problems • apply problem-solving approaches to ratio problems • use mathematical conventions when expressing ratios and fractions • show systematic working and units.
Resources	For guidance on providing feedback, see the professional development packages titled: • *About feedback* www.qsa.qld.edu.au/downloads/p_10/as_feedback_about.doc • *Seeking and providing feedback* www.qsa.qld.edu.au/downloads/p_10/as_feedback_provide.doc

Background information for teachers

Ratios
A ratio is a set of numbers that show the relationship between two or more like quantities or measures.
A ratio is *not* a fraction, but can be represented as a fraction. For example, a ratio of 1 part lemonade to 2 parts ginger ale can be written as 1:2 or $\frac{1}{2}$. In this case, the fraction is *not* referring to the fraction of lemonade to the whole, which is $\frac{1}{3}$.
Ratios can be represented as a percentage. For example, a ratio of 1:3 could be represented as 25% and 75%.
Ratios can be represented using a colon ':' to show the relationship between the values, where the colon means 'is to'. For example, 5:1 means 'five is to one'.
The order of values is very important when representing ratios. That is, 5:1 is different from 1:5.
Ratios represented in ratio or fraction form can be simplified down to their simplest terms. For example, 2:10 = 1:5; $\frac{3}{9} = \frac{1}{3}$.

Refreshing drinks

Name ....

Purpose of assessment: Students use procedures and an understanding of ratios, fractions and percentages to solve problems when mixing ingredients for fruity drinks.

Understanding and Skills		
Understanding and Fluency		**Problem solving and Reasoning**
Procedural fluency — recall and use of facts, definitions, technologies and procedures (Q1–6, 7ab, 8, 9) Expressing quantities as ratios, fractions, and percentages. Operating with fractions and percentages to solve ratio problems.	**Use of mathematical language, conventions and symbols (Q1–10)** Using conventions to express quantities as ratios, fractions and percentages. Showing working and making use of units.	**Application of problem-solving approaches (Q7c, 10)** Solving problems involving ratios.
Use of procedures to express quantities as ratios, fractions, and percentages. Use of ratios and operations involving fractions or percentages to solve problems involving ratios of three quantities (Q8, 9).	Effective and clear use of conventions when writing ratios and fractions. Detailed working and consistent use of appropriate units.	Systematic application of problem-solving approaches to correct a drink mixed in an incorrect ratio and to determine the required quantities for mixing a punch. **A**
Use of equivalent fractions and ratios, and of operations involving fractions or percentages, to solve problems involving ratios of two and three quantities (Q5–7b).		**B**
Use of procedures to express quantities as ratios, fractions, equivalent fractions and percentages (Q1–3). Use of equivalent fractions and ratios, and of operations involving fractions or percentages, to find solutions in problems involving ratios (Q4).	Satisfactory working and use of conventions when writing ratios, fractions and units.	Progress in application of problem-solving approaches to correct a drink mixed in an incorrect ratio or to determine the required quantities for mixing a punch. **C**
	Use of aspects of conventions when writing ratios and fractions. Some working and use of units.	Some application of problem-solving approaches to correct a drink mixed in an incorrect ratio. **D**
Partial use of procedures to express some quantities as ratios, fractions, equivalent fractions or percentages.		**E**

Australian Curriculum Year 7 Mathematics	Refreshing drinks	Task-specific standards — continua

Refreshing drinks

Name ....

Purpose of assessment: Students use procedures and an understanding of ratios, fractions and percentages to solve problems when mixing ingredients for fruity drinks.

			A	B	C	D	E
Understanding and Skills dimensions	**Understanding & Fluency**	**Procedural fluency — recall and use of facts, definitions, technologies and procedures (Q1–6, 7ab, 8, 9)** Expressing quantities as ratios, fractions, and percentages. Operating with fractions and percentages to solve ratio problems.	Use of procedures to express quantities as ratios, fractions, and percentages. Use of ratios and operations involving fractions or percentages to solve problems involving ratios of three quantities (Q8, 9).	Use of equivalent fractions and ratios, and of operations involving fractions or percentages, to solve problems involving ratios of two and three quantities (Q5–7b).	Use of procedures to express quantities as ratios, fractions, equivalent fractions and percentages (Q1–3). Use of equivalent fractions and ratios, and of operations involving fractions or percentages, to find solutions in problems involving ratios (Q4).	Some use of procedures to express quantities as ratios, fractions, equivalent fractions and percentages. Some progress in solving problems involving ratios.	Partial use of procedures to express some quantities as ratios, fractions, equivalent fractions and percentages.
		Use of mathematical language, conventions and symbols (Q1–10) Using conventions to express quantities as ratios, fractions and percentages. Showing working and making use of units.	Effective and clear use of conventions when writing ratios and fractions. Detailed working and consistent use of appropriate units.	Consistent use of conventions when writing ratios and fractions. Consistent working and use of appropriate units.	Satisfactory working and use of conventions when writing ratios, fractions units.	Use of aspects of conventions when writing ratios and fractions. Some working and use of units.	Partial writing of ratios and fractions.
	Problem solving & Reasoning	**Application of problem-solving approaches (Q7c,10)** Solving problems involving ratios.	Systematic application of problem-solving approaches to correct a drink mixed in an incorrect ratio and to determine the required quantities for mixing a punch.	Application of problem-solving approaches to correct a drink mixed in an incorrect ratio or to determine the required quantities for mixing a punch.	Progress in application of problem-solving approaches to correct a drink mixed in an incorrect ratio or to determine the required quantities for mixing a punch.	Some application of problem-solving approaches to correct a drink mixed in an incorrect ratio.	Partial application of problem-solving approaches.

Refreshing drinks

Image: © The State of Queensland (Queensland Studies Authority) 2014

Students apply understanding of ratios, fractions and percentages to solve problems when mixing ingredients for fruity drinks.

You will:
- express the quantities of ingredients in mixed fruity drinks as ratios, fractions and percentages
- solve problems involving mixing and adjusting the ratios of ingredients.

Section 1. Mei's orange concentrate

A new brand of fruit juice concentrate called **Mei's orange concentrate** is available at your local shop.

This type of fruit juice drink comes in a concentrated form. You need to mix water with it before it is ready to drink.

1. A glass contained the ratio shown below:
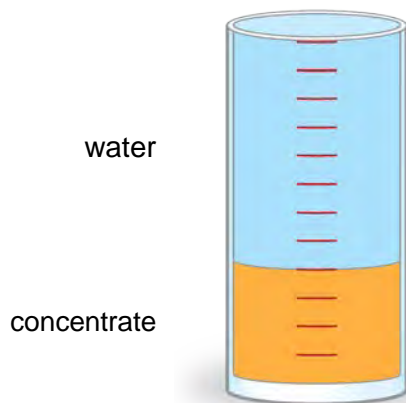
    water

    concentrate

    The ratio of concentrate to water is:

    ....

2. The instructions on the bottle say to mix it in the ratio 1:7 (1 part concentrate to 7 parts water). Draw a picture to illustrate this ratio.

3. You decide to try an overly concentrated drink and use 3 parts fruit juice concentrate. It's too strong and you decide mix it in the ratio 1:7 according to the instructions on the bottle.

   a. How many parts of water should you add to the 3 parts fruit juice concentrate?

   ....

   b. Draw a picture to show the quantities of fruit juice concentrate and water used.

   c. Write this as a ratio. 3: ....

   d. Write this ratio as a fraction. ....
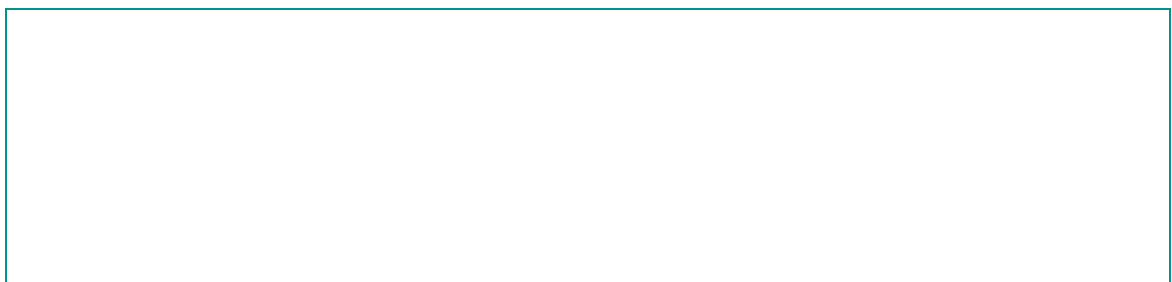
   e. Write an equivalent fraction in its simplest form. ....

4. When the fruit juice concentrate is mixed with water in the ratio 1:7 …

   a. What fraction of the mixture is concentrate?
      Show your working.

   b. What percentage (%) of the mixture is concentrate?
      Show your working.

c. What fraction of the mixture is water?
   Show your working.

d. What percentage (%) of the mixture is water?
   Show your working.

5. You like to keep some mixed drink in the fridge.

   a. To make a mixture using 400 mL of concentrate, how much water would you add?
      Show your working, using answer/s from Question 4.

   b. How much mixed drink would this make?
      Show your working.

6. You need to mix 5.6 litres of mixed drink to take to sports training.

    a. How much concentrate and water do you need?
        Show your working.

7. One day you wrongly mix up some drink by adding 500 mL of concentrate to 1500 mL of water.

    a. What is the ratio of concentrate to water? (Express this ratio in its simplest form.)

    ....

    b. Does the drink contain too much concentrate or too much water? Explain how you know.

    ....

    ....

    ....
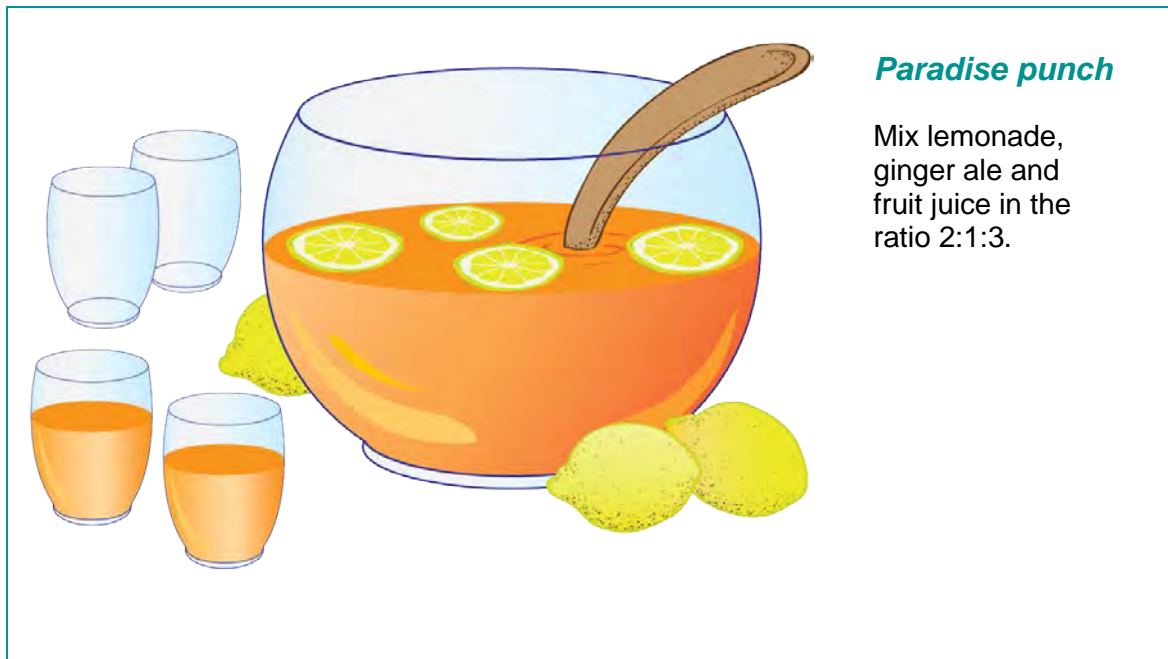
    c. How would you adjust the mixture so it is mixed correctly?
        Show your working.

Section 2. Paradise punch

You volunteer to make up a fruit punch for a party.

Paradise punch

Mix lemonade, ginger ale and fruit juice in the ratio 2:1:3.

8. You decide to test your recipe by making a small amount in a glass, and then plan to make up a large bowl of fruit punch to take to the party.

    a. If you add 80 mL of lemonade to a glass, how much ginger ale and fruit juice would you have to you add?

    b. How much Paradise punch does this make?

c. Express the ratio of each ingredient as a percentage of the whole.

9. When you arrive at the party, you have left your measuring jug at home so you have to measure the ingredients using a cup.

You put one cup of lemonade in the punch and then add the other ingredients.

a. How many cups of the other ingredients would you add?

b. How many cups of punch does this make? Show your working.

You want to make up enough punch so everyone can have 4 cups each. There are 12 people at the party.

10. How many cups of each ingredient would you use? Show your working