

**GRADE 12 ESSENTIAL
UNIT D – PRECISION MEASUREMENT**

Name: _____

Date: _____

WORKBOOK (with answers)

**A Selection of Questions for Precision Measurement from Manitoba
Archived Provincial Exams**

*Manitoba Education and Advanced Learning School Programs Division
Winnipeg, Manitoba, Canada*

<https://www.edu.gov.mb.ca/k12/assess/archives/#es>

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The Meaning of Directing Words on Tests	
identify/choose	the appropriate answer(s) from a given list of choices
state	a word, sentence, or number, without an explanation
describe/explain	words or symbols, diagrams, charts or graphs, or other methods that clearly show what you are thinking
justify/support	an explanation, information, or evidence that shows why your method, idea, or answer is correct
sketch	a reasonably neat picture or diagram (not necessarily to scale) that shows or explains an idea, concept, or method
calculate/determine	a mathematical formula, an algebraic equation, or a numerical calculation to solve a problem

DIRECTIONS FOR A TEST

(This is just a workbook though! Not hand-in)

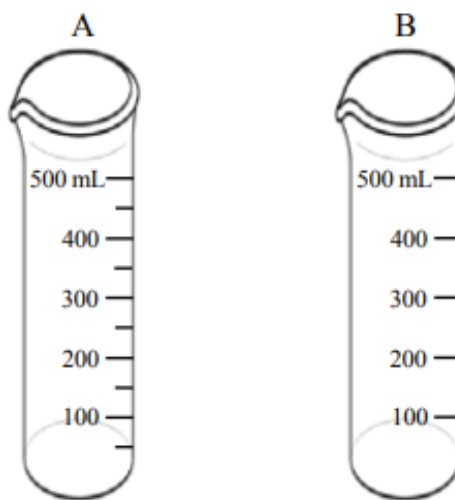
- ◆ Show complete answers in the space(s) provided on a test. In this workbook there is likely not enough room! Use your own paper for this workbook.
- ◆ Let the mark values for each question guide you in answering the question.
- ◆ Show all your work on a test so you can get part marks and to organize your thoughts.
- ◆ Be sure to include units in your final answer.
- ◆ Use your Formula Sheet and your study sheet.
- ◆ Provide explanations and justifications.
- ◆ Use a well-organized method to communicate your answer. *ie:* Label steps, label calculations, box answer(s), write answer in words, show side calculations

JANUARY 2019 PROVINCIAL EXAM

31. Rick is measuring the volume of a liquid using the cylinders at right:

A) State the precision of cylinder A. (1 mark)

B) Justify which cylinder is more precise. (1 mark)

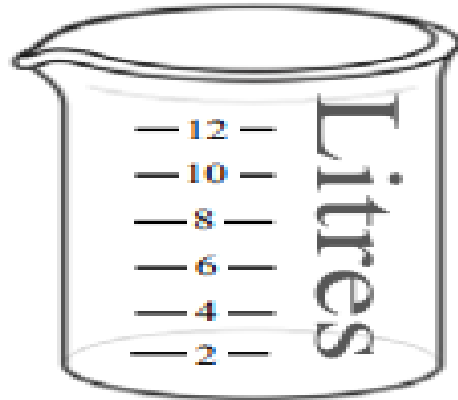


Ans:

A) 50 mL B) various

32. Marco needs to mix water with his eco-friendly herbicide concentrate for his garden. If too little water is added to the herbicide, it will kill his vegetables. However, if too much water is added, the herbicide will not be effective.

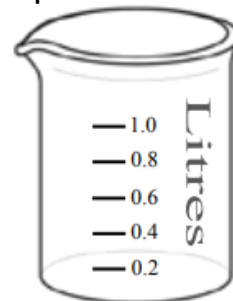
Big Bucket:



A) State the uncertainty of the measurement if Marco uses the big bucket. (1 mark)

B) If Marco needs to add 12 L of water to the herbicide using a smaller measuring cup, calculate the total uncertainty of the measurements if Marco uses the container 12 times. (2 marks)

Measuring Cup:

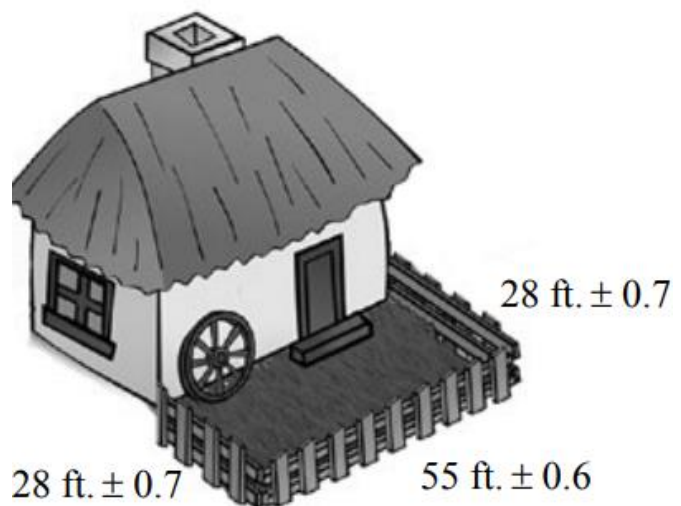


A) ± 1 L or just 1 L

B) ± 1.2 L or just 1.2 L

33. A yard is being fenced on three sides as shown.

Calculate the maximum length of fencing required given the measurements and the uncertainties above. (2 marks)



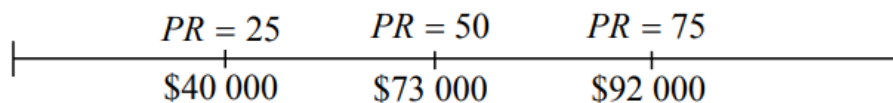
Ans: 113 ft

34. The tolerance of a measurement is 0.007 m (ie: 7 mm). The nominal value, which is the maximum, is 15.084 m. Choose an acceptable measured value from the list below:

- A) 15.091 m B) 15.078 m C) 15.098 m D) 15.070 m

ANS: B)

35. Statistics for family income are available for the town of St. Lamont. The family incomes for the 25th, 50th, and 75th percentile ranks are shown below.



- A) State the percent of families that earn more than \$92 000. (1 mark)
 B) There are 1416 families in the town of St. Lamont. Calculate how many families earn more than \$92 000. (1 mark)

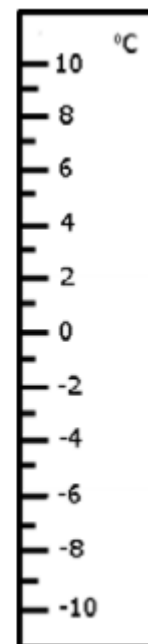
ANS: A) 25% B) 354

JANUARY 2018 PROVINCIAL EXAM

29. Explain which of the thermometers is more precise.



Thermometer A



Thermometer B

Ans: Thermometer B since each tick mark graduation is 1°C.

30. Choose the letter that best completes the sentence below. How close a measurement is to the true value refers to:

- A) tolerance B) accuracy C) precision D) uncertainty

Ans: B

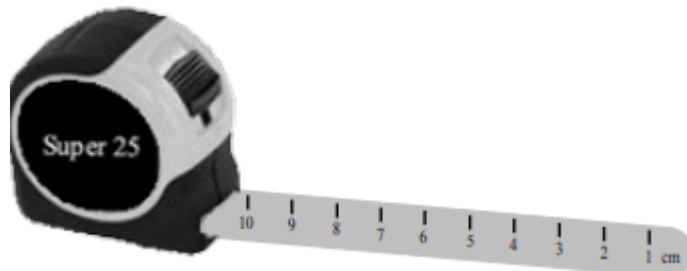
31. Jordana is having a ring made by a jeweller. Her ring is to weigh 4.86 grams. Calculate the uncertainty of the weight of her ring. Do not round your final answer.

Ans: 0.005 g

32. Jonalee is a veterinarian. Her thermometer indicated a dog's temperature to be 38.6 C. ° State the precision of the thermometer she used. Do not round your final answer.

Ans: 0.1 C

33. Mario is installing a subfloor using sheets of plywood. He measures a sheet of plywood to be 225 cm long using the tape measure shown below.



Calculate the minimum possible length of the sheet of plywood. Do not round your final answer.

Ans: 224.5 cm

34. Choose the letter that best completes the sentence below. The tolerance expression that allows for a maximum value greater than 16.5 cm is:

A) $16.5 \text{ cm } {}_0^{+0.5 \text{ cm}}$

B) 16.5 cm
 15.5 cm

C) $16 \text{ cm } \pm 0.5 \text{ cm}$

D) $16.5 \text{ cm } {}_{-1 \text{ cm}}^{+0}$

Ans: A)

35. Oumar is cutting lenses for a pair of glasses. In order for the lenses to fit into the frame, the lenses need to have a minimum thickness of 1.896 mm and a maximum thickness of 2.022 mm. State the measurement in the form:

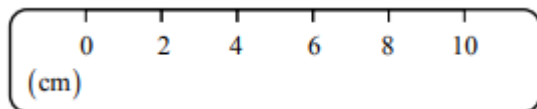
$$\text{maximum value } {}_{-tolerance}^{+0}$$

Do not round your final answer.

Ans: $2.022 \text{ mm } {}_{-0.126}^{+0}$

January 2017 PROVINCIAL EXAM

26. Given the measuring device below:



State the precision.

Precision: _____

Ans: 2 cm

27. Given the following form of tolerance for a measurement:

$$5.3 \text{ cm } \begin{matrix} +0.4 \text{ cm} \\ -0.3 \text{ cm} \end{matrix}$$

- A) State the maximum value. (1 mark)
 B) State the minimum value. (1 mark)
 C) State the tolerance. (1 mark)

A) 5.7 cm B) 5.0 cm C) 0.7 cm

29. Explain why the concept of tolerance is important when installing closet doors or windows.

Ans: various

30. A refrigerator has a maximum temperature of 37.5 F° and a minimum temperature of 32.7 F° . State the tolerance in the form

$$\text{nominal value } \begin{matrix} +\text{tolerance} \\ -0 \end{matrix}$$

Ans: 32.7 °F $\begin{matrix} +4.8 \text{ °F} \\ -0 \end{matrix}$

31. A lemonade bottling company fills 500 mL bottles. Explain why the company should be accurate when measuring the amount of lemonade it puts in each bottle.

Possible Ans: – The company must be accurate to avoid overfilling and spilling. – The company must be accurate for quantity control. – Customer satisfaction—ensure bottle isn't under filled

32. Mathville has a population of 1 200 000 people and Megatropolis has a population of 3 108 000 people. The following table shows the percentage of people who speak English as their first language.

	Population	% of people who speak English as a First Language
Mathville	1 200 000	84.6%
Megatropolis	3 108 000	65.3%

Calculate the percentage of people who speak English as their first language in both cities combined using a weighted mean.

Ans: 70.68%

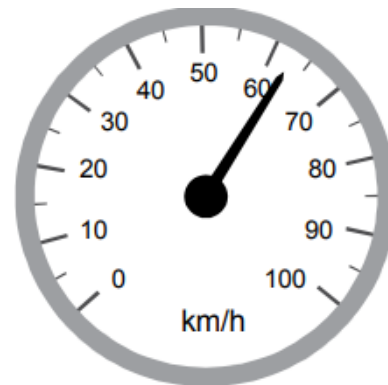
JAN 2016

1. Refer to the diagram of a speedometer.

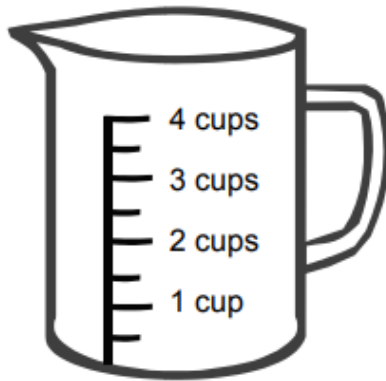
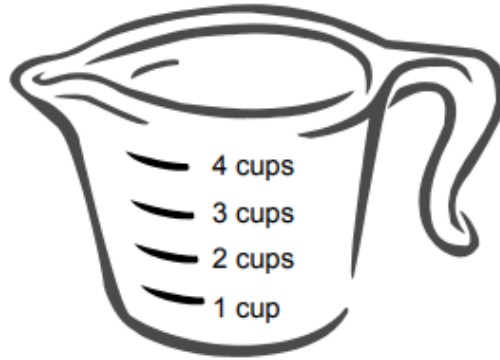
A) State the precision of the speedometer.

B) State the uncertainty of the speedometer

ANS: A) 5 km/h B) ± 2.5 km/h



2. Johnny needs to measure $1\frac{3}{4}$ cups of water to make bread. Justify [explain in words!] which of the following measuring cups is more precise.

**A****B**

ANS: Johnny should choose cup A because it has smaller increments shown which makes it more precise.

3. Jill buys a roll of wallpaper. She uses a measuring device with a precision of 1 cm to measure and cut a 95 cm piece.

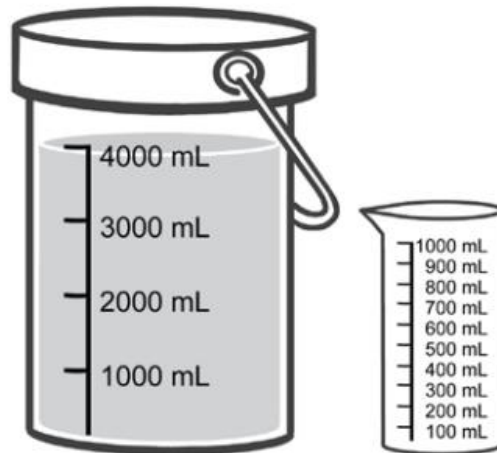
A) State the maximum length of the cut piece of wallpaper.

B) State the minimum length of the cut piece of wallpaper.

ANS: Max 95.5 cm, Min 94.5 cm

4. Colin has a bucket, marked in 1000 mL increments, that he fills with 4000 mL of liquid fertilizer. He wants to remove 300 mL of the liquid fertilizer. He uses a 1000 mL container marked in 100 mL increments.

Calculate the remaining amount of mixture that will be in the bucket in the format: **measurement \pm uncertainty**



ANS: 3700 mL \pm 550 mL

5. Ralph is painting his living room with a custom colour that was created at the paint store by mixing colours. He did not buy enough paint and needs to buy more. Explain why a degree of accuracy is needed when mixing additional paint to match his original colour.

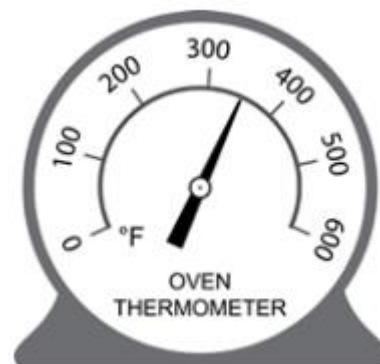
Ans: If the colours are not mixed with the correct amounts it will not match the custom colour

JUN 2016

6. State the precision and uncertainty of the oven thermometer shown.

Precision: _____

Uncertainty: _____



ANS: Precision: 100F;
Uncertainty: 50F

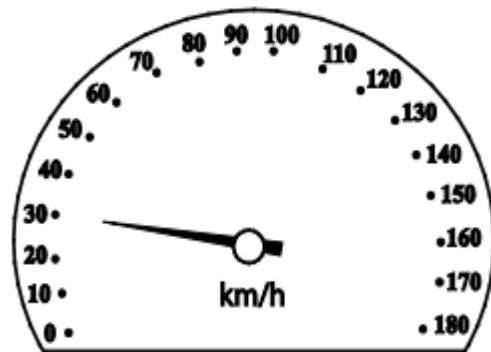
7. A student measured a piece of rope using 5 different measuring tapes with the same precision. He recorded the following measurements:

5.34 m	5.32 m	5.37 m	5.34 m	5.38 m
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State the precision of the measuring tapes.

ANS: 0.01 m or 1 cm

8. The speed limit in a school zone is 30 km/h. Evan's speedometer reads 30 km/h. Explain why Evan may be pulled over for exceeding the speed limit using one of the following concepts: accuracy, tolerance, uncertainty, or precision.



Ans: – Evan's speedometer could be inaccurate. – The speedometer's reading has an uncertainty of 5 km/hr. – The officer's radar instrument may not be calibrated accurately. – The officer's radar instrument may have a very low tolerance for speeding (e.g., 30km/ hr $\begin{matrix} +4 \text{ km/hr} \\ -0 \text{ km/hr} \end{matrix}$)

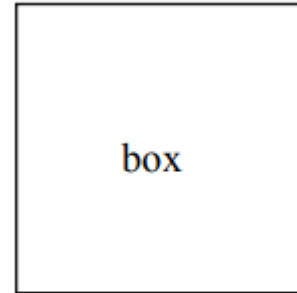
9. A company makes sticks for frozen fruit snacks with a measurement of $15.5 \text{ cm} \begin{matrix} +0 \text{ cm} \\ -0.2 \text{ cm} \end{matrix}$

- A) State the maximum length.
- B) State the minimum length.

ANS: A) 15.5 cm B) 15.3 cm

10. Rajiv places 4 boxes side by side. Each box is built to measure $12'' \pm \frac{1}{32}''$ in width.

Calculate the combined width of the boxes in the format: **measurement \pm uncertainty**.



$$12'' \pm \frac{1}{32}''$$

Ans: $48'' \pm \frac{4}{32}''$

JUN 2017

17. Leanne measures her height to be 168 cm. State the uncertainty of the measurement. Do not round the final answer.

Uncertainty: _____

ANS: ± 0.5 cm

19. Explain why a pharmacist must use accurate dosages when preparing medications.

Sample answers: – A pharmacist must be accurate so the medication can be most effective. – A pharmacist must be accurate to prevent an overdose. – A pharmacist must be accurate to ensure a sufficient quantity of medication (to prevent an under dose). – The pharmacy would lose money if extra medication was dispensed.

20. Given the following measurement: $56.0 \text{ cm} \pm 0.3 \text{ cm}$

A) State the minimum value. Do not round the final answer.

B) State the tolerance of the measurement. Do not round the final answer

ANS: A) 55.7 mm B) 0.6 mm

21. Three of the four forms of tolerance listed below indicate the same measurement in megahertz. Choose the form of tolerance that indicates a different measurement.

A) $16 \pm 0.3 \text{ MHz}$

B) $\frac{16.3}{15.7} \text{ MHz}$

C) $15.7 \begin{smallmatrix} +0.3 \\ -0.3 \end{smallmatrix} \text{ MHz}$

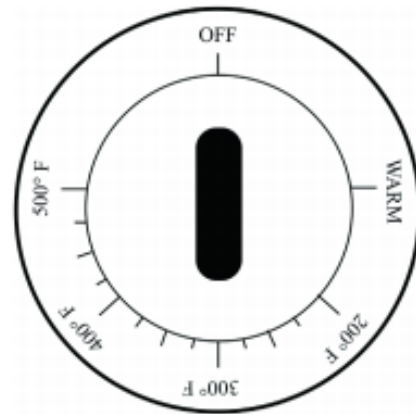
D) $15.7 \begin{smallmatrix} +0.6 \\ -0.0 \end{smallmatrix} \text{ MHz}$

ANS: C

22. The recommended oil capacity of an engine has a maximum volume of 52.5 mL and a minimum volume of 47.5 mL. State the measurement in the form: *nominal value* $\pm \frac{1}{2}$ (*tolerance*)

ANS: $50 \pm 2.5 \text{ mL}$

23. State the precision of the oven dial.



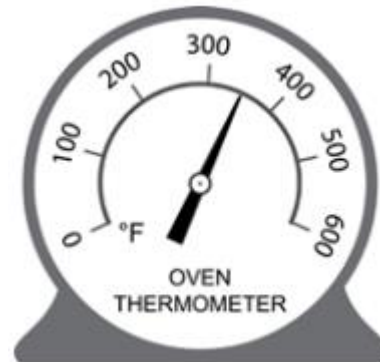
ANS: 25°F

JUN 2016

6. State the precision and uncertainty of the oven thermometer shown.

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Uncertainty: _____



ANS: Precision: 100F;
Uncertainty: 50F

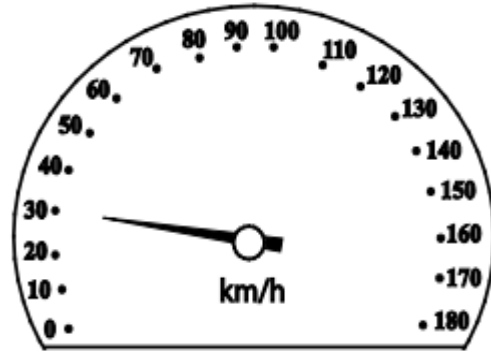
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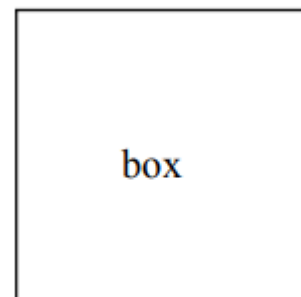
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