Welcome to:

MATERIALS SCIENCE NMC 113 (2023)

Introduction or the "rules of the game!"

Staff members who will guide you

Study-leader, lecturer of Group GO1 and coordinator of test and exam marks:

Mr Vinod Kurup: Eng II building : 4-4.1

Lecturer of Group G02: Dr Tulani Mukarati
Eng II building : 4-4.1

Tutors: Mr. Tresor
Heavy Machinery Lab 2-17

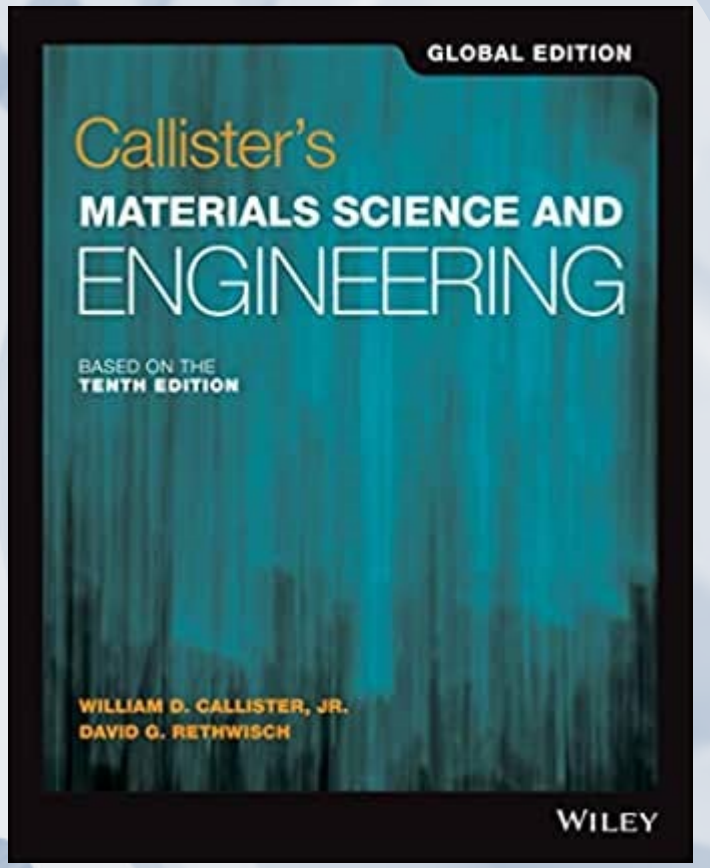
Coordinator of Practicals: Mr.Sibusiso Mahlalela,
Heavy machinery
Lab-2/5.1

Coordinator of Tutor-classes and Wiley-Plus: Mr. Muhammed Salojee
Eng II building : 4-4.1

Study components

❑ Hand book and Wiley-Plus

Callister, W.D. & Rethwisch, D.G. 2011/2015
Materials Science and Engineering.
9th/10th Edition **(containing Wiley Plus)**
New York: John Wiley.



❑ Clickup

- **Study Guide**
- **Practical Guide**
- **Class notes and PP Slides**
- **Communication**
- **Self-do assignments, publishing of marks etc**

Classes for Group GO1

Lectures

Monday	Tuesday	Wednesday	Thursday	Friday
ENG III-1 13:30-14:20	ENG III-1 13:30-14:20		ENG III-1 13:30- 15:20	ENG III-1 7:30-8:20

Study Components

- Lectures
- Practicals (4) Online reports
- Tutor Classes (4) - (every second week, alternates with the 4 practicals)
- Two Class Tests (dates will be announced)
- Wiley Plus: self-do questions and tests
- Self-study problems (assignments) on Clickup (not for marks but serve as preparation for tests and the exam)

Study Components (1)

Practicals (4)

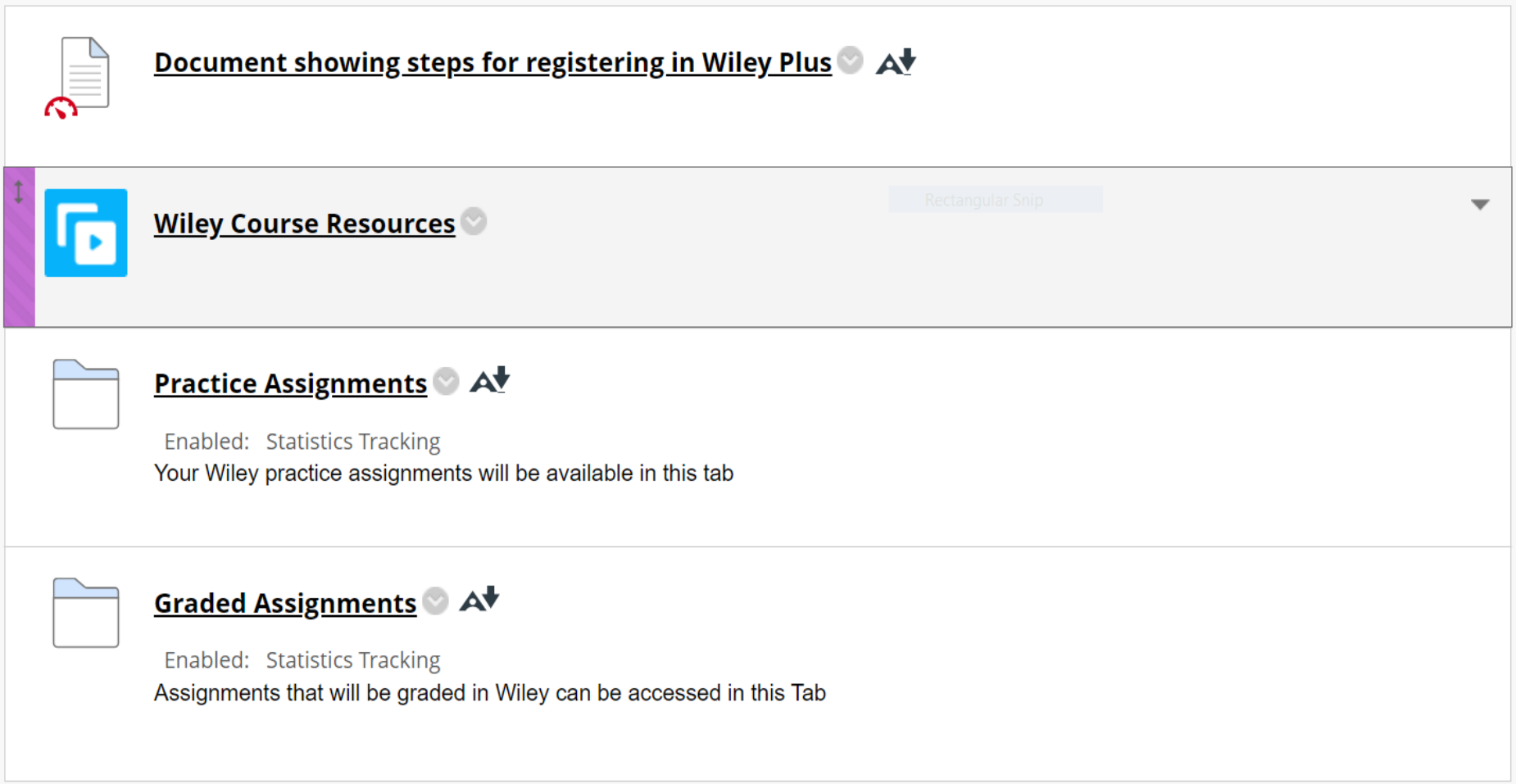
- Theory is within the “Practicals Guide”
- Video on each practical will be placed on Clickup
- Test to be written before each experiment (Clickup)
- Reporting sheet of results to be completed by each student individually on ClickUp
- In case if regulations allow to attend practical on venue make sure you have lab coat and closed shoes as this is mandatory requirement to attend practicals

Study Components (2)

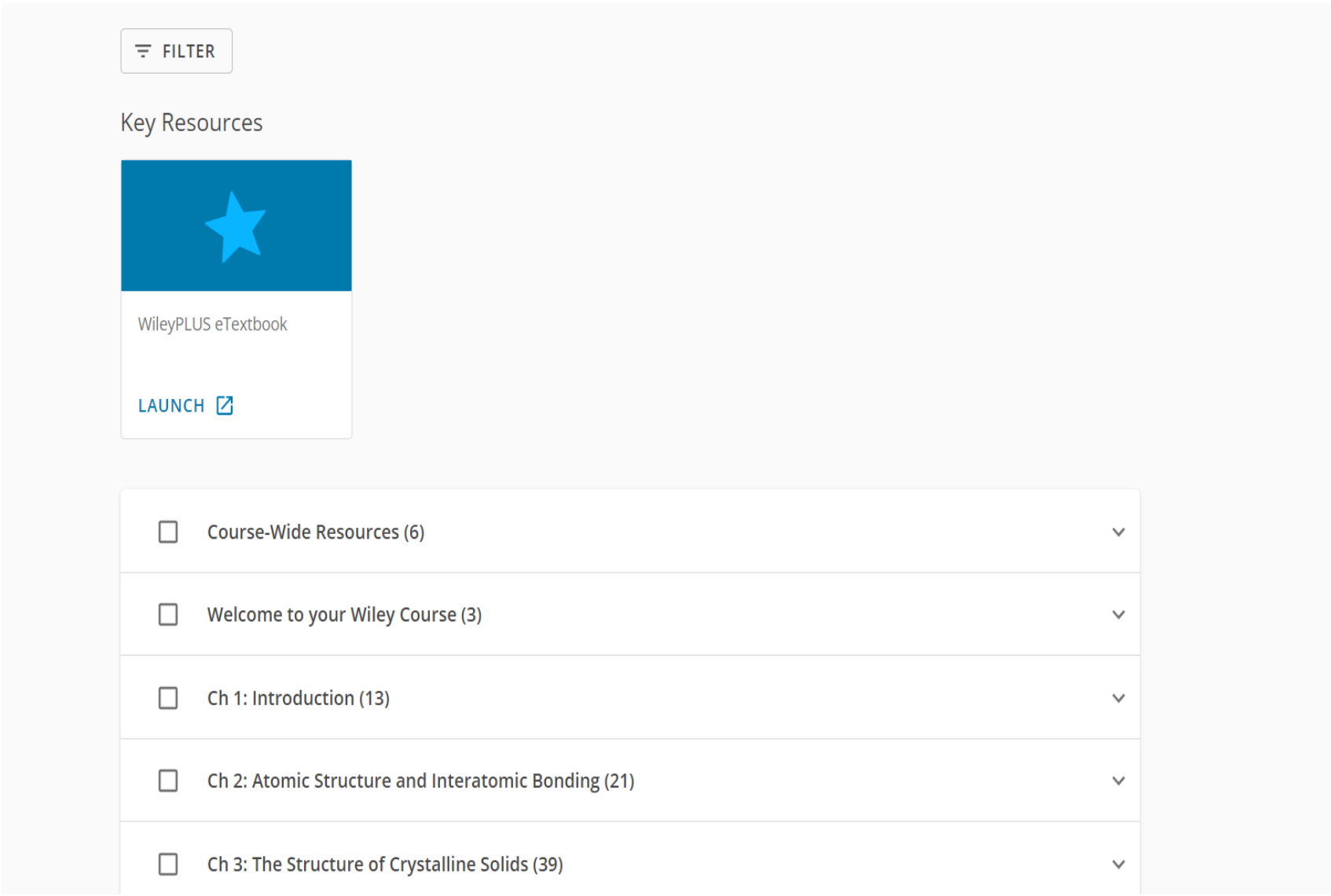
Tutor Classes

- Practice on how to solve problems
- Taught to use Wiley Plus
- Attention to individual students is possible

Study Components (3)



Costs for the Wiley-plus electronic access code are included in the class fees



1st Page of Wiley resources

Study Components (4)

Methodology of the "two-step" test and exam assessments:

<u>Section 1</u>: Multiple Choice section (often 40% of the total): Here you are given mostly five definitions on a single concept of which one (or none?) is correct. This tests your fundamental understanding of the concept.
Basic example: "Is running water (i) a liquid, (ii) a solid, (iii) a gas or (iv) neither of these?

<u>Section 2</u>: Problem solutions by calculations (often 60% of the total):

"Engineers calculate and do not write essays"

Study Components (5)

Assessments

Calculation of the final module mark:

Semester Mark 50%, Exam mark 50%.

Calculation of the semester mark:

Semester tests (2x):	60 %
Laboratory work (Practicals):	10 %
Class tests:	10 %
Tutor classes:	10 %
Wiley Plus continuous assessment:	10 %

Study Components (6)

Allowance to write the final examination:

- **All 4 practicals were successfully completed**
- **50 % minimum for the overall practical mark**
- **Tutor Classes are compulsory and they contribute to the semester mark and your fundamental understanding of Materials in Engineering**
- **NMC 113: 30 % semester mark for access to the final exam**

Study Components (7)

ECSA: Engineering Council of South Africa

- Accreditation of study content and outputs
- Five-year re-accreditation awarded in 2017

How much time should I spend on this module?

- 16 SAQA Credits (SA Quality Authority)
- 160 hours total/semester
- Lectures: ~ 48 hours, 4x50 minutes/week, over 14 weeks
- Practicals and Tutor Classes: 12 hours
- Tests and exam: 6 hours
- Self study: 94 hours over 14 weeks of 5-6h/week
- ABC: “Attach Bottom to Chair”!!

Study Components (8)

To be successful:

- **Class attendance, class attendance, class attendance!!!**

- **Work hard in the semester: aim for a 60% semester mark**
- **Do not give up if there is anything that you do not understand, please come and ask for assistance!!!**
- **Assistance: Practicals/ Tutor Classes/ Lecturers/WILEY PLUS**
- **Syllabus' outcomes are in the study guide!**
- **Group Work**
- **ClickUp test**
- **Own problems from Callister or Wiley-plus (ABC, ABC, ABC…)**

- **We are here to help you!!**

Introduction to the use of units in the engineering of materials

1. Transformations of SI units
2. Mathematical solutions of problems
   - ln: Arrhenius type equations (e^x)
   - Logs (10^x)
   - Square root equations $a^{0.5}$
   - reading off values from log graphs
   - Use of graphical representations

Exponential graphs

Arrhenius type equations

Exponential growth is exhibited when the rate of change—the change per instant or unit of time—of the value of a mathematical function is proportional to the function's current value

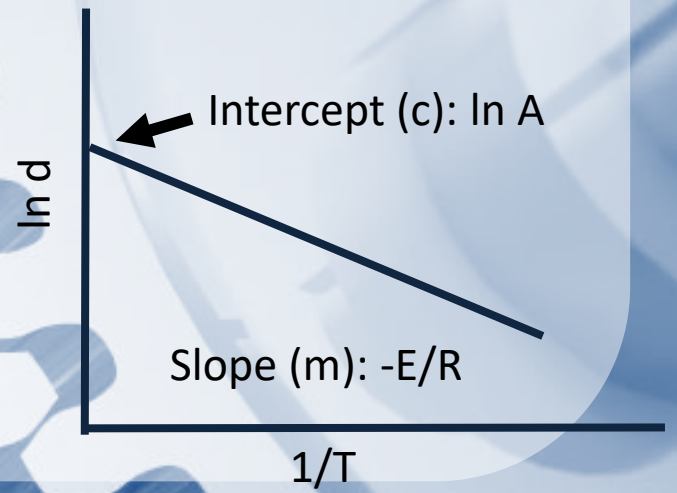
$$d = Ae^{-E/RT} \quad \text{or} \quad d = A \exp(-E/RT)$$

Convert to a straight line equation of
y = mx+c (m = slope, c = intercept)

$$\ln(d) = \ln A - (E/RT)$$

$$\ln(d) = \ln A - \{(E/R)(1/T)\}$$

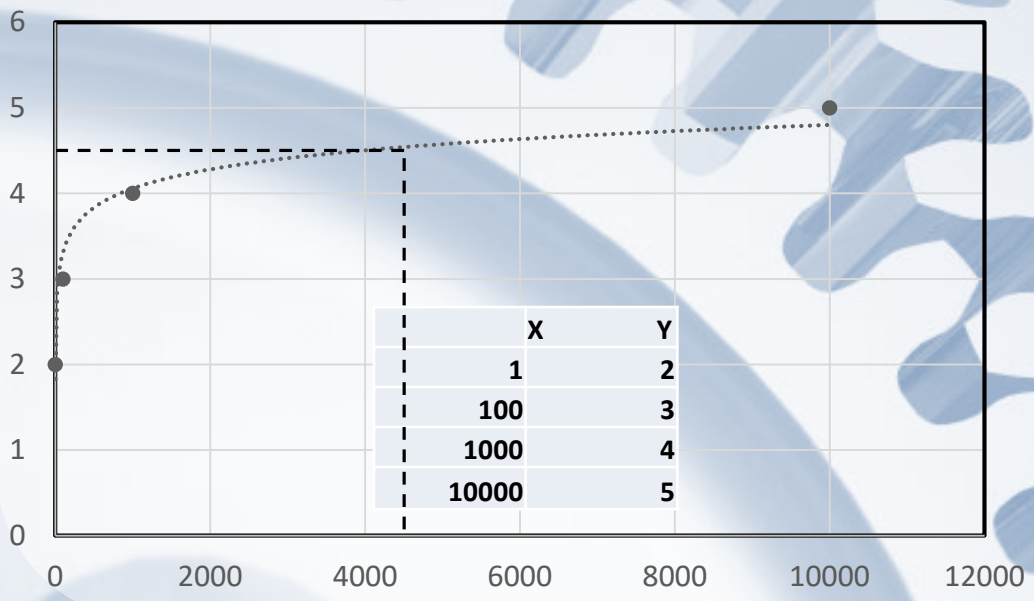
E = Activation energy (J/mol)
R= gas constant 8.314 J/mol.K
Note: E/RT has no units



Reading off values from a linear graph

Example: Find the value for Y at X = 4200?

Answer: Y = 4.4



Reading off value from a logarithmic graph

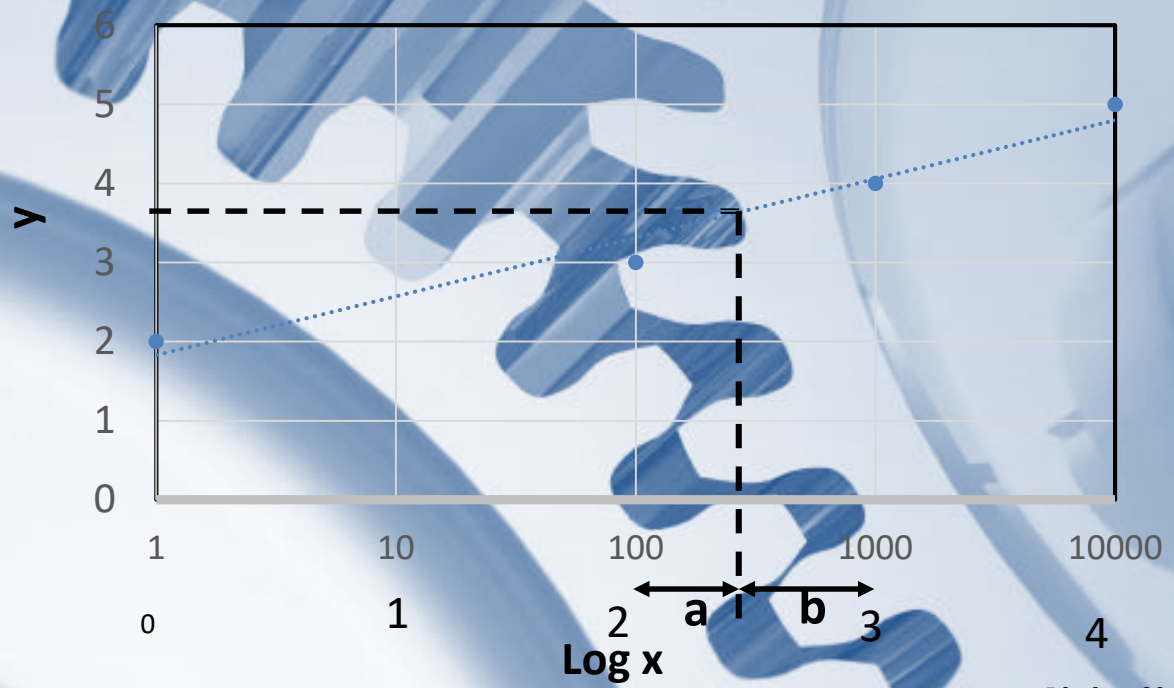
ample: Find the value for X at Y = 3.7?

swer: X must lie between 100 and 1000 (but where?)

e the log scale: X lies between 10^2 and 10^3?

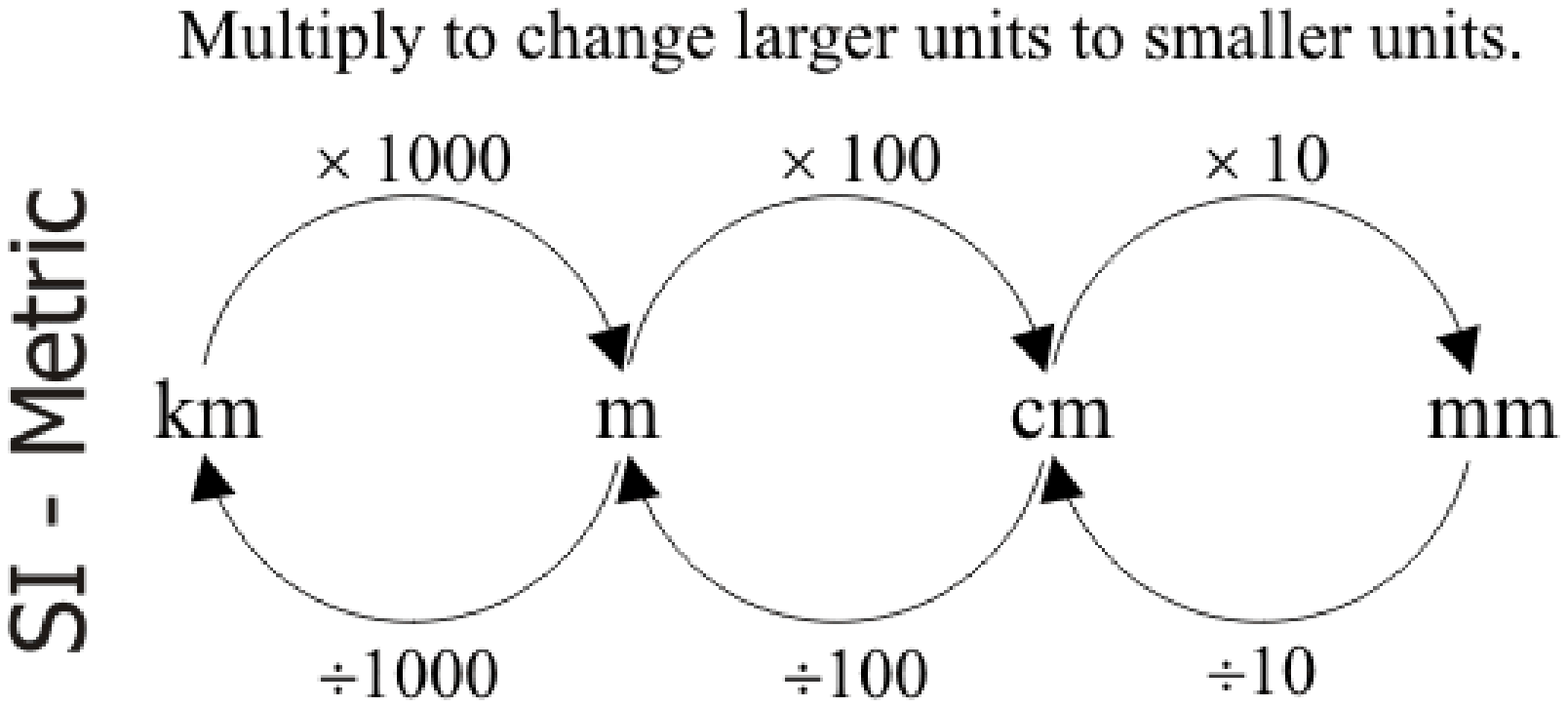
e log exponents climb linearly, one can interpolate

erefore $X=10^{2.4} = 251.2$



Answer: $10^{[(2)+\{(a)/(a+b)\}]}$

The SI units


Multiply to change larger units to smaller units.
SI - Metric
× 1000
× 100
× 10
km
m
cm
mm
÷1000
÷100
÷10

The SI system

Prefixes

Name	*Prefix*	*Factor*
tera	T	10^{12}
giga	G	10^{9}
mega	M	10^{6}
kilo	k	10^{3}
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}