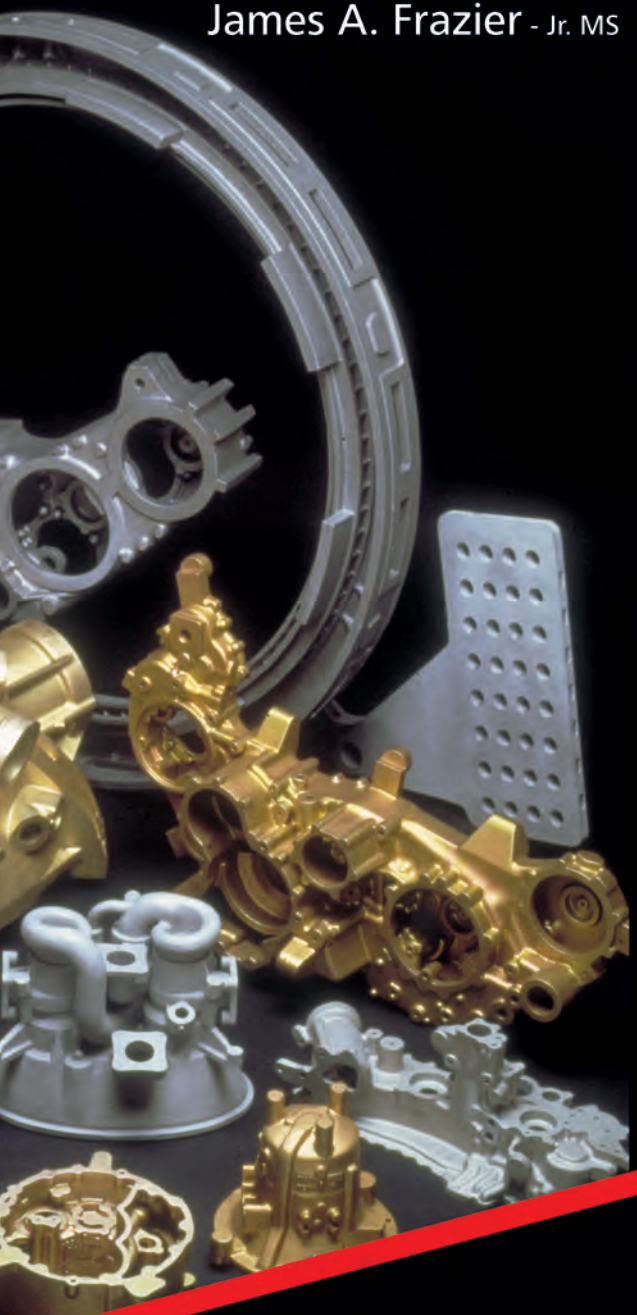
CAREER PATHS

Engineering

Charles Lloyd
James A. Frazier - Jr. MS



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CAREER PATHS

Engineering

Book 1

Charles Lloyd
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Scope and Sequence

Unit	Topic	Reading context	Vocabulary	Function
1	What is Engineering?	Magazine article	design, develop, discipline, engineer, inspect, machine, mathematics, physics, technology	Asking for directions
2	Shapes	Blog	arch, architect, cylinder, ellipse, geometric, oval, prism, rectangle, semi-circle, square, vault	Asking about purpose
3	Materials	Bid sheet	ceramic, coated, concrete, glass, lumber, porcelain, reinforced, stainless steel, steel, textured, tile	Talking about budgets
4	Tools	Manual	clip, drill, pliers, screwdriver, screws, solder, soldering iron, strip, vise, wire stripper	Describing uses
5	Energy	Abstract	abstract, decelerate, force, G, kinetic energy, potential energy, stopping distance, transfer, work, work-energy principle	Supporting an idea
6	Simple Machines	Textbook passage	complicated, fulcrum, inclined plane, lever, leverage, load, pulley, simple machine, wedge, wheel and axle	Giving examples
7	Working with Numbers	Guide	cubed, equals, exponents, hundredths, percent, squared, tenths, thousandths, times, to the -th power	Identifying an error
8	Types of Measurement	Email	centimeter, feet, gallon, imperial, inch, kilogram, liter, meter, metric, pound	Describing frequency
9	The Scientific Method	Proposal	control, data, experiment, hypothesis, methodology, observation, problem, procedure, result, variable	Making a suggestion
10	Safety Precautions	Poster	accident, burn, fire extinguisher, first aid, glove, goggle, hazard, injury, precaution, prohibited, shock	Asking about causes
11	Civil Engineering	Job posting	civil engineer, commercial, construction, infrastructure, land development, municipal, residential, road construction, scale, topographic, water supply	Describing a preference
12	Chemical Engineering	Newspaper article	alternative fuel, biodegradable, biodiesel, chemical engineer, diesel, fossil fuel, fuel, non-toxic, petroleum, renewable	Asking for an opinion
13	Mechanical Engineering	Website	CAD, CAM, CFD, drafting, mechanical engineering, mechanism, pressure vessel, prototype, simulation, stress	Describing limitations
14	Electrical Engineer	Email	circuit, circuit board, component, input voltage, integrated circuit, output power, output voltage, power supply, volt, watt	Changing deadlines
15	Aerospace Engineering	Notice	aircraft, airframe, airworthiness, flyaway value, licensed production, passenger miles per gallon, propellant, ramjet, space vehicle, thrust	Correcting an error

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CAREER PATHS

Engineering

Book 2

Charles Lloyd
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Express Publishing

Scope and Sequence

Unit	Topic	Reading context	Vocabulary	Function
1	History of Engineering	Textbook passage	catapult, counterweight, fortification, mass, mechanical advantage, payload, pivot, projectile, siege engine, sling, torque, trebuchet	Proposing a solution
2	Traits of an Engineer	Job posting	common sense, competency, courage, curiosity, degree, dependability, interpersonal, long-term, organizational, problem solving, quality, quantitative thinking	Describing interests
3	An Engineer's Education	Seminar schedule	ABET, accredited, bachelor's degree, doctorate, EAB, entry-level, master's degree, MEng, MSc, MSc(Res), PhD, postgraduate degree, undergraduate degree	Talking about plans
4	Presenting Information	Email	body language, citation, cue card, general-to-specific strategy, handout, KISS, objective, presentation program, projector, signpost, summarize, visual aid	Asking for feedback
5	Problem Solving	Email	analysis, application, approach, attack, comprehension, iteration, iterative procedure, logic, problem identification, redefine, solution, synthesis	Asking about progress
6	Creativity	Notice	abstract, concrete, convention, creative, feedback, innovation, norm, originality, out-of-the-box, plausible, verification	Pointing out flaws
7	Tables and Graphs	Report	bar graph, dependent, graph, independent variable, line graph, scatter plot, variable, x-axis, y-axis	Agreeing with an idea
8	Dimensions and Drawings	Email	CAD drawing, cross-section, depth, diagram, dimensions, exploded view, geometry, length, perimeter, schematics, width	Bringing up a problem
9	Materials and Properties	Website	brittle, conductor, ductility, hardness, insulator, luster, malleable, natural, plastic, synthetic, tensile, transparent	Describing properties
10	Working with Numbers	Email	calculation, convention, digit, integer, leading zero, notation, order of magnitude, quantity, rounding error, scientific notation, significant figure, trailing zero	Making an apology
11	Sales Engineering	Email	advertising, commission, competitor, consult, demonstrate, expertise, liaison, marketing, modify, technical, technological	Describing willingness
12	Agricultural Engineering	Advertisement	agriculture, crop, distribution uniformity, drainage, flood irrigation, hydrology, irrigation, localized irrigation, pivot irrigation, salinity, tillage, water rights	Asking about options
13	Industrial Engineering	Report	assembly line, capacity, conveyor, cost-effective, ergonomics, facility layout, inventory, logistics, quality control, streamline, supply chain	Confirming information
14	Software Engineering	Magazine column	assess, computer science, design, development, maintenance, operation, problem modeling, quality, software engineering, testing, validation, verification	Asking about success
15	Genetic Engineering	Newspaper article	deficiency, DNA, DNA probe, expression, gene, GMO, manipulate, molecular cloning, select, trait, vector	Asking about differences

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CAREER PATHS

Engineering

Book 3

Charles Lloyd
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Scope and Sequence

Unit	Topic	Reading context	Vocabulary	Function
1	Newton's Laws	Email	acceleration, friction, inertia, mass, motion, net force, Newton's first law, Newton's second law, Newton's third law, rest, vector, velocity	Asking for an opinion
2	Laws of Thermodynamics	Newspaper article	absolute zero, conservation of energy, entropy, equilibrium, First Law of Thermodynamics, heat, internal heat, Kelvin, Second Law of Thermodynamics, system, temperature, Third Law of Thermodynamics	Talking about effects
3	Rate Processes	Report	diameter, driving force, flow rate, flux, inlet, outlet, Poiseuille equation, pressure, rate, resistance, superfluid, viscosity	Expressing doubts
4	Statics and Dynamics	Email	dynamics, free body diagram, load, magnitude, moment, portable, rigid body, safety factor, stability, statics, vibration	Being cautious
5	Electricity	Newspaper article	anode, battery, cathode, charge, conductor, electrode, insulator, lithium, PTC, separator sheet, vent hole	Making a prediction
6	SI System of Units	Report	base unit, candelas, derived unit, grams, luminance, luminous intensity, measurements, SI system of units, solid angle, square meter, steradian, supplementary unit	Describing benefits
7	Engineering Design Method	Email	assemble, constraint, construct, criteria, detailed design, evaluate, feasibility study, identify, narrow, preliminary design, sketch, verify	Explaining a choice
8	Models	Résumé	3-D, analog computer model, digital computer model, empirical, IDEF, mathematical model, modeling language, physical model, qualitative model, simulation, UML, VRML	Describing experience
9	Accounting	Report	conserved quantity, consumption, extensive quantities, generation, input, intensive quality, output, path quantity, state quantity, steady state, system, universal accounting equation	Expressing interest
10	Statistics	Proposal	bell curve, central tendency, frequency, histogram, outlier, population, range, raw data, sample, sort, statistical quality control, variation	Including drawbacks
11	Computer Engineering	Newspaper article	algorithm, artificial intelligence, circuit analysis, computer networking, control engineering, digital signal processing, fault-tolerant computer system, human-computer interaction, interactive systems engineering, robotics, software engineering, VSLI	Describing changes
12	Materials Engineering	Job postings	drilling, extrusion, geology, geophysics, injection molding, mud logging, offshore, onshore, petroleum, polymer, raw material, refining, research and development, well, wellbore hydraulics	Getting into a topic
13	Environmental Engineering	Report	conservation, detoxification, environment, fauna, flora, habitat, hazardous, impact assessment, migration, pollution, runoff, sewage treatment facility, species	Expressing reservations
14	Nuclear Engineering	Article	breeder reactor, fissile, fossil fuel, fuel rod, nuclear chain reaction, nuclear fission, plutonium-239, radioactive, reprocessing, thermal energy, thermal power station, uranium-235	Backing up an argument
15	Biomedical Engineering	Product descriptions	CT, diagnosis, dialysis, heart-lung machine, implant, infusion pump, medical imaging, MRI, pacemaker, prosthetic, respirator, slice, treatment, ultrasound, X-ray, incubator	Asking about risks

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3 Rate Processes

Get ready!

1 Before you read the passage, talk about these questions.

1 Why might the flow of a liquid be important to an engineer?

2 When do engineers consider rate processes?

SMITH AND ASSOC. ENGINEERING, LLC

Hose Pressure Problem Study for New York City Fire Department

Background

The City of New York asked *Smith and Assoc. Engineering, LLC* to look into recent complaints from the New York City Fire Department about weak hose **pressure** and low **flow rates** when attempting to extinguish fires.

Findings

Since the water being used across the city is approximately the same temperature and quite far from becoming a **superfluid**, we assumed that the water was not the problem. After all, water of the same temperature exhibits a consistently low **viscosity** according to the **Poiseuille equation**.

We suspected therefore that the problem must be with the **rate** at which the water is being forced through the hoses. Taking measurements at the **inlet** and **outlet** of a standard-issue fire hose confirmed these suspicions. The rate of **flux** at the outlet was lower than that at the inlet, meaning that the **driving force** behind the water was simply too weak.

Suggestions

The simplest solution would be to decrease the **diameter** of the hoses used by the department. This would cause an increase in **resistance**, forcing the water to speed up as it goes through the hose, and increasing the flow rate and pressure at the outlet.

$$\Delta p = \frac{8\eta Q \Delta x}{\pi r^4}$$

Poiseuille equation

diameter

inlet

outlet

flow rate

Reading

2 Read this report from an engineering firm. Then, choose the correct answers.

1 What is the report mostly about?

A the impact of viscosity on flow rates

B the importance of high water pressure

C the reason for a flow rate problem

D the fire hoses' inlet design flaws

2 Which of the following caused the problem?

A high-viscosity fluids

B small-diameter hoses

C too much outlet pressure

D insufficient driving force

3 Using smaller-diameter fire hoses will likely

A increase the viscosity of the water.

B reduce complaints from firefighters.

C decrease the pressure placed on the outlets.

D create budget problems for the fire department.

Vocabulary

3 Read the sentence pairs. Choose where the words best fit in the blanks.

1 **inlet / outlet**

A larger _____ lets more water flow in.

The small _____ can't release the water fast enough.

2 **pressure / driving force**

The _____ behind the water is the pump.

Putting too much _____ on glass will break it.

3 **resistance / viscosity**

The tube's small diameter is creating a lot of _____ .

The liquid's high _____ won't let it flow quickly.

4 **flux / rate**

Determine the liquid's _____ as it passes through a screen.

The tank is being filled at a _____ of ten liters an hour.

4 **Use the words or phrases from the word bank to fill in the blanks.**

WORD BANK

flow rate diameter
Poiseuille equation superfluid

1 A _____ can move out of a container by itself.
2 The _____ of the circle is 7.5 centimeters.
3 Increase the pipe size if the _____ is too low.
4 Apply the _____ to that problem.

5 **Listen and read the report again. Why is the water pressure believed to be low?**

Listening

6 **Listen to a conversation between a civil engineer and a fire chief. Mark the following statements as true (T) or false (F).**

1 __ The man worries that the hoses are too expensive.
2 __ The woman believes that viscosity is the problem.
3 __ The man decides to change all of the inlets.

7 **Listen again and complete the conversation.**

Engineer: Well, your firefighters say that the flow of water from their fire hoses is too weak, correct?
Chief: That's right.
Engineer: I see. Well, I think we've found a solution.
Chief: What's that?
Engineer: The water **1** _____ is obviously the same across the entire city, so that's not the issue.
Chief: Okay. That makes sense.
Engineer: Instead, we believe the **2** _____ of your hoses is too big for the amount of pressure you're getting at the inlet.
Chief: I see. So we need **3** _____ _____ ?
Engineer: Correct. If the **4** _____ _____ behind the water entering the hose stays the same, a smaller hose would increase the **5** _____ at the outlet.
Chief: I'm not sure that'll work. It would probably be **6** _____ _____ .
Engineer: Well then you've only got one other option, and that's to replace all of the **7** _____ you're using.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then, switch roles.**

USE LANGUAGE SUCH AS:

Well, I think we've found a solution.
So we need smaller hoses?
I'm not sure that'll work.

Student A: You are a civil engineer. Talk to Student B about:

- the problem
- cause of problem
- solutions

Student B: You are a fire chief. Answer Student A's questions.
Make up an name for the engineer.

Writing

9 **You are an engineer trying to solve a flow rate issue. Use the report and the conversation from Task 8, to write about the causes and a potential solution (100-120 words). Write about:**

- Why the flow rate is lower than your client would like it to be
- How viscosity impacts the flow rate
- How you can increase the flow rate

6 SI System of Units

Light-Reflecting Material:

Summary and Specifications

Engineers here at Parker Engineering have developed a new, lightweight material that reflects light. This report details the experiment process and results.

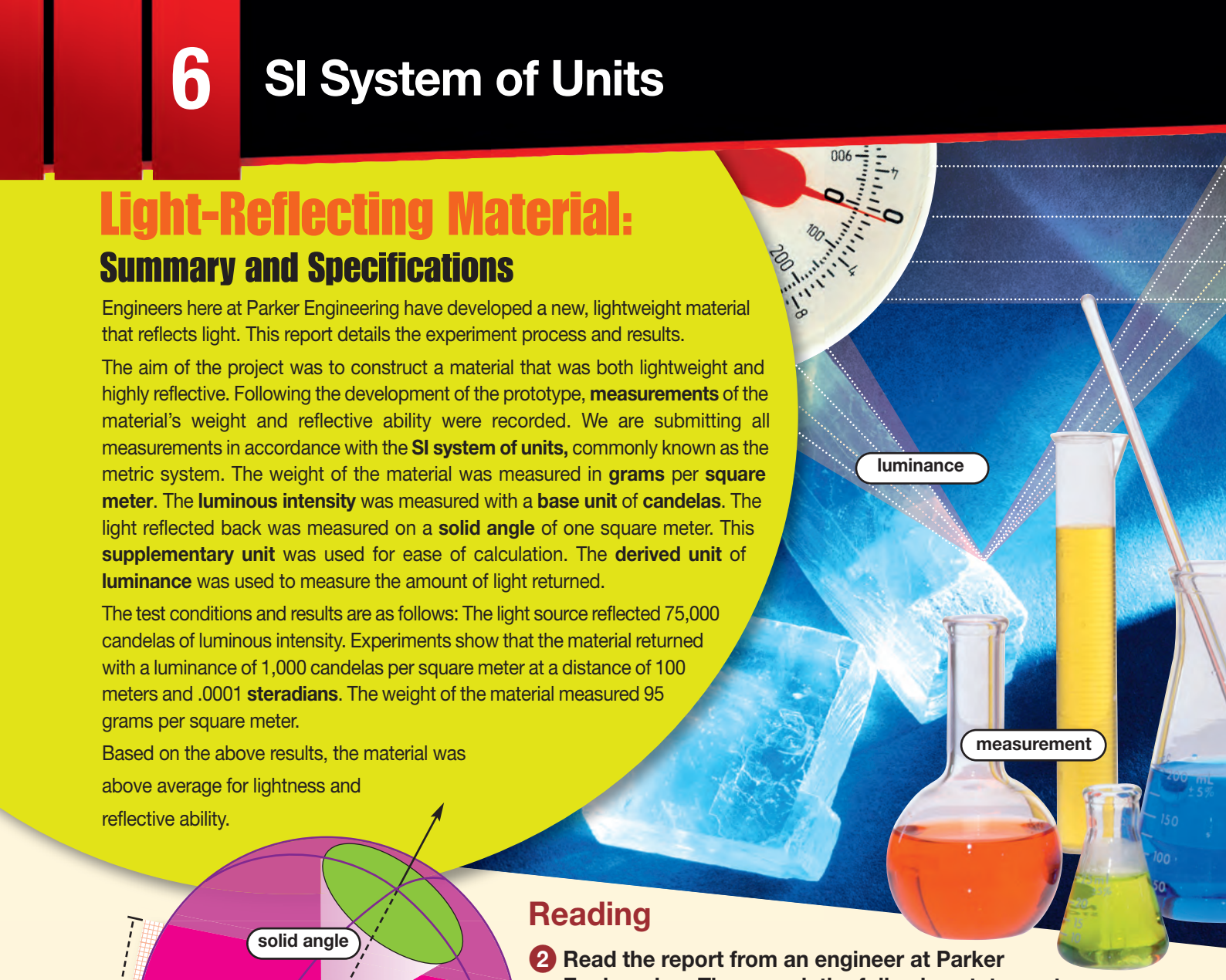
The aim of the project was to construct a material that was both lightweight and highly reflective. Following the development of the prototype, **measurements** of the material's weight and reflective ability were recorded. We are submitting all measurements in accordance with the **SI system of units,** commonly known as the metric system. The weight of the material was measured in **grams** per **square meter**. The **luminous intensity** was measured with a **base unit** of **candelas**. The light reflected back was measured on a **solid angle** of one square meter. This **supplementary unit** was used for ease of calculation. The **derived unit** of **luminance** was used to measure the amount of light returned.

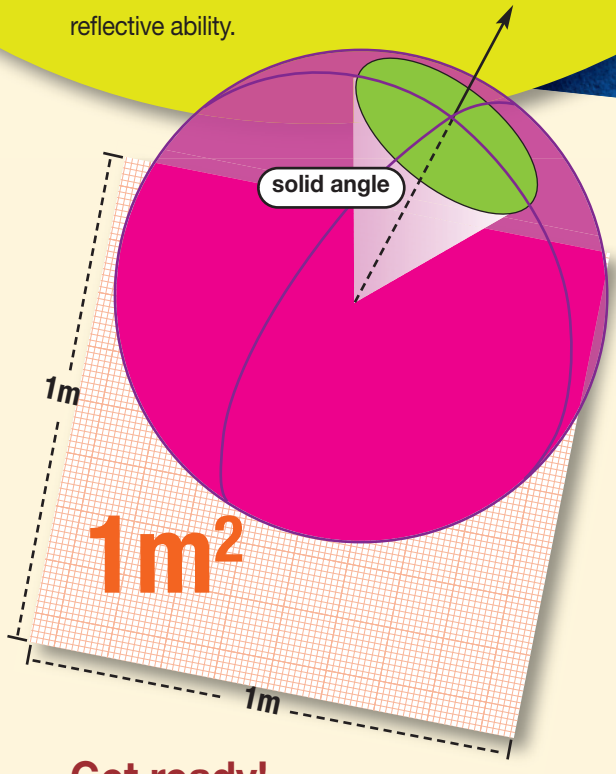
The test conditions and results are as follows: The light source reflected 75,000 candelas of luminous intensity. Experiments show that the material returned with a luminance of 1,000 candelas per square meter at a distance of 100 meters and .0001 **steradians**. The weight of the material measured 95 grams per square meter.

Based on the above results, the material was

above average for lightness and

reflective ability.





Get ready!

1 Before you read the passage, talk about these questions.

1 What types of measurement are you familiar with?

2 What can you measure with the SI system of units?

Reading

2 Read the report from an engineer at Parker Engineering. Then, mark the following statements as true (T) or false (F).

1 __ Engineers recorded the material's reflective ability.

2 __ Luminous intensity was measured with candelas.

3 __ The prototype did not meet the weight requirements.

Vocabulary

3 Match the words or phrases (1-7) with the definitions (A-G).

1 __ luminous intensity

2 __ supplementary unit

3 __ solid angle

4 __ base unit

5 __ steradian

6 __ SI system of units

7 __ derived unit

A a measurement system with seven types of units

B a two-dimensional angle in a sphere

C the power of light the human eye can perceive

D a unit of measurement formed by combining base units

E a measurement unit beyond the seven basic types

F a unit of measurement for angles

G one of seven basic units of measurement

4 Write a word or phrase that is similar in meaning to the underlined part.

1 One <u>unit of measurement for mass</u> is very light. g _ _ m
2 This lamp emits 120 <u>units of luminous intensity</u>. c _ n _ _ l _ s
3 Record the exact <u>dimensions</u>. _ _ a _ _ r _ m _ _ _ s
4 How many <u>units of measurement for area</u> is the yard? _ q _ _ r _ m _ _ e _ s
5 Measure the <u>reflection's brightness from a distance</u>. _ u _ _ n _ _ c _

5 Listen and read the report again. How much does the new material weigh?

Listening

6 Listen to a conversation between an engineer and a clothing manufacturer. Choose the right answers.

1 What is the main idea of the dialogue?
- **A** describing the production process
- **B** selling the material to a manufacturer
- **C** reducing how much the material weighs
- **D** negotiating the cost of the material

2 According to the dialogue, what is NOT an advantage of the product?
- **A** It does not weigh very much.
- **B** It is extremely reflective.
- **C** Its price has been reduced.
- **D** It can be placed on safety clothing.

7 Listen again and complete the conversation.

E: Ms. Platt, thanks for **1** _____ _____ _____ to meet with me.
M: My pleasure. So, what's this great new product you mentioned on the phone?
E: It's a super reflective material. Its **2** _____ is very high.
M: And what exactly is it designed for?
E: It would work great for **3** _____ _____ . Small strips placed on uniforms can reflect large amounts of light.
M: And how much does it cost?
E: Well, the production process is rather involved. So it costs about 70 dollars **4** _____ _____ _____ .
M: That's **5** _____ _____ _____ . Other reflective materials are available for less.
E: But ours reflects twice as much light as others. So you use less of it.
M: Good point. It **6** _____ _____ .

Speaking

8 With a partner, act out the roles below based on Task 7. Then, switch roles.

USE LANGUAGE SUCH AS:

What's this great new product you mentioned on the phone?

It's a super reflective material. / How much does it cost?

Student A: You are a clothing manufacturer. Ask Student B about a new material's:
- uses
- cost

Student B: You are an engineer. Answer Student A's questions. Make up a name for the manufacturer.

Writing

9 You are an engineer who has developed a new reflective material. Use the report and conversation from Task 8 to write a brief journal article about the material (100-120 words). Write about:

- The uses of the product
- The characteristics of the product
- Why this product is better than others

Glossary

abstract [N-COUNT-U5] An **abstract** is a summary of an article, document, or other text.

accident [N-COUNT-U10] An **accident** is something bad that was not meant to happen.

alternative fuel [N-COUNT-U12] An **alternative fuel** is a substance that is used for energy instead of fossil fuels.

arch [N-COUNT-U2] An **arch** is a semicircle shape over an entrance.

architect [N-COUNT-U2] An **architect** is a person whose job is to design and build structures.

biodegradable [ADJ-U12] If something is **biodegradable**, it will break apart naturally.

biodiesel [N-UNCOUNT-U12] **Biodiesel** is fuel that is made from vegetable oils or animal fat.

burn [N-COUNT-U10] A **burn** is damage caused by heat or fire.

CAD [ABBREV-U13] **CAD** (computer-aided design) refers to using computer technology to create computer models of objects.

CAM [ABBREV-U13] **CAM** (computer-aided manufacturing) refers to the use of computer technology to help build the parts of a machine.

centimeter [N-COUNT-U8] A **centimeter** is a metric measurement of distance that is equal to one one-hundredth of a meter.

ceramic [N-UNCOUNT-U3] **Ceramic** is a solid material made from clay or similar materials.

CFD [ABBREV-U13] **CFD** (computational fluid dynamics) refers to the use of mathematical formulas to study problems related to the movement of fluids and gases.

chemical engineer [N-COUNT-U12] A **chemical engineer** is someone who works in the chemical industry.

circuit card assembly [N-COUNT-U14] A **circuit card assembly** is a card with all components installed that can be used to perform a variety of tasks in electrical equipment.

civil engineer [N-COUNT-U11] A **civil engineer** is a person who works with the design and construction of the physical environment. This includes buildings, roads, bridges, and other things.

clip [V-T-U4] To **clip** something is to cut off part of it.

coated [ADJ-U3] If something is **coated**, it is covered by some type of material.

commercial [ADJ-U11] Something that is **commercial** is related to business or commerce.

complicated [ADJ-U6] If something is **complicated**, it has many details or is hard to understand.

component [N-COUNT-U14] A **component** is a part of something bigger.

concrete [N-UNCOUNT-U3] **Concrete** is a construction material made out of cement, crushed rocks, and other materials.

construction [N-UNCOUNT-U11] **Construction** is the process of building structures such as buildings, roads, and bridges.

control [N-COUNT-U9] A **control** is a situation or condition that you do not change during an experiment.

convert [V-T-U12] To **convert** something is to change it from one thing to another.

cubed [ADJ-U7] If a number is **cubed**, it is to be multiplied by itself three times.

CAREER PATHS

Engineering

Career Paths: Engineering is a new educational resource for engineering professionals who want to improve their English communication skills in a work environment. Incorporating career-specific vocabulary and contexts and reviewed by leaders within the engineering industry, each unit offers step-by-step instruction that immerses students in the four key language components: reading, listening, speaking, and writing. ***Career Paths: Engineering*** addresses topics including tools, materials, numbers, engineering concepts, converting measurements, and career options.

The series is organized into three levels of difficulty and offers over 400 vocabulary terms and phrases. Every unit includes a test of reading comprehension, vocabulary, and listening skills, and leads students through written and oral production.

Included Features:

- A variety of realistic reading passages
- Career-specific dialogues
- 45 reading and listening comprehension checks
- Over 400 vocabulary terms and phrases
- Guided speaking and writing exercises
- Complete glossary of terms and phrases

The **Teacher's Guide** contains detailed lesson plans, a full answer key and audio scripts.

The **audio CDs** contain all recorded material.

Express Publishing

ISBN 978-1-78098-016-4

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