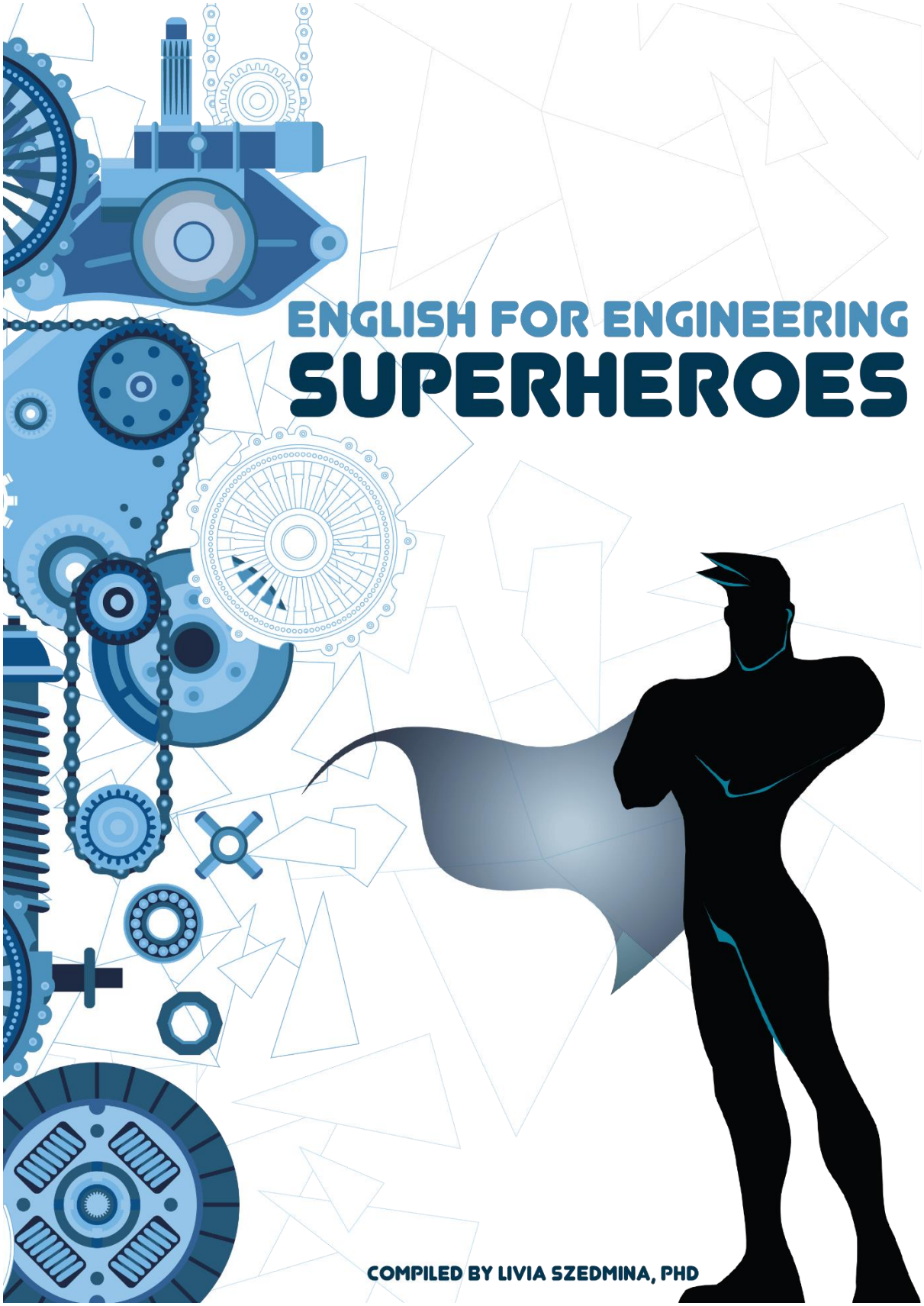

ENGLISH FOR ENGINEERING
SUPERHEROES
COMPILED BY LIVIA SZEDMINA, PHD

Tips for making it as an engineering student

Go big or go home.

One day or day one. You decide.

You didn't come this far to only come this far.

Don't limit your challenges. Challenge your limits.

Don't watch the clock, do what it does: keep going.

Self-confidence is the best outfit. Rock it and own it.

Don't stop when you're tired. Stop when you're done.

The only place 'success' comes before 'work' is in the dictionary.

Essential skills engineers need to 'make it'

If you work in engineering, you need a combination of hard and soft skills. Hard skills are related to specific technical knowledge and training while soft skills are personality traits such as leadership, communication or time management. To successfully perform and advance in engineering jobs, both types of skills are necessary.

COMMUNICATION AND INTERPERSONAL SKILLS. Having great communication skills is vital in any engineering job. It is needed in brainstorming, project meetings, designing products and, most of all, problem solving. As a mechanical engineer, IT specialist, or technical manager, you will often need to discuss plans or designs with others, at all levels in an organization. The ability to clearly communicate is essential to collaborative work. It is particularly important when working with non-engineers, as the engineer must take technical information and convey it clearly to those without advanced technical knowledge. This way, everyone involved understands the progress and options. Interpersonal skills mean that you must be able to have a positive attitude towards yourself, others, and circumstances. You practice your interpersonal skills by cooperating in the workplace, interacting with people in a friendly and professional manner, and being responsible and accountable for the work assigned to you.

TEAMWORK. Few engineering projects will see an engineer working on their own without coworkers or outside professionals. Teamwork skills are essential for ensuring you can cooperate with teammates to succeed as a unit and perform to your highest combined ability. Working collaboratively with different types of people at every level requires you to use skills such as verbal communication, appropriate body language, goal-setting, and prioritizing problems. You must be able to listen to the ideas and concerns of your peers in order to be an effective team member. By asking questions for clarification, demonstrating concern, and using nonverbal cues, you can show your team that you care and that you understand their ideas or concerns. You want to be a reliable team member so that your coworkers can trust you with time-sensitive tasks and company information. Make sure you keep the deadlines and complete any assigned work. This will help you gain your colleagues' trust. Convey respect for your team members and their ideas. Simple actions like using a person's name, making eye contact, and actively listening when a person speaks will make your team members feel appreciated. In a trusting work environment it is much easier to give honest feedback and also be open to feedback.

PROBLEM SOLVING. In an engineering role it is crucial to have an analytical mind and critical thinking skills. Being a confident problem solver is really important to your success. Much of that confidence comes from having a good problem-solving approach to find a quick and effective solution. As an engineer, you must be able to identify, assess and analyze complex problems, then offer and implement solutions to address a problem. You must make quick decisions when handling urgent

situations. It is advisable to always focus on the solution, not the problem itself. Also, engineering, management or IT problems will sometimes require you to think outside the box. In your daily job, you will need to handle obstacles and possibly, failures, then turn them into a learning experience. Ultimately, you become better at problem solving.

TECHNICAL SKILLS Engineering is a domain where your training never ends, even after years of professional schooling. Developing a set of critical technical skills is vital for keeping up with the latest engineering developments. Skills such as understanding manufacturing processes, principles of robotics and the basics of quality control is essential for enter any field of engineering. While programming skills are primarily associated with IT, AutoCAD and SolidWorks are industry standards for 3-D design, so the programming of robots requires knowledge of AutoCAD, as does 3-D printing. Most manufacturers of robots use special software to program the equipment, although knowledge of Python or C/C++ provides a good base. You should always be willing to undergo additional technical training since most companies use different software and systems. Having strong technical skills will define your ability to identify and solve arising problems.

TIME MANAGEMENT Time management is the process of setting a defined amount of time to a specific task to achieve a fixed result, i.e., success. The by-product of successful time management is that you complete your task efficiently and also increase your productivity. Setting goals is the first step to becoming a good time manager. Goal-setting allows you to clearly understand your end goal and what exactly you need to prioritize to achieve your goal. Staying organized can help you maintain a clear picture of what you need to complete and when. There are many ways to prioritize what you need to accomplish. You might decide to complete fast, simple items followed by longer, more complex ones. Alternatively, you might prioritize your tasks starting with the most time-sensitive, or a combination of both. When practicing good time management, you should also be aware of pressure and stressful situations. Handling stress in a positive way can help you stay motivated and perform well when going through your schedule. You might do this by including small breaks throughout your day, or by rewarding yourself in small ways as you accomplish tasks.

LEADERSHIP AND MANAGEMENT SKILLS Engineers ought to be leaders and managers. A good definition of leadership as a soft skill is taking responsibility for yourself and also for the people you work alongside. Engineers are given different responsibilities depending on the project but sometimes they are assigned to lead and handle a team. As a leader, you must be able to assess and utilize a

member's strength and ability in order to maximize manpower and build an efficient team. Your interpersonal skills will get you a long way: getting along with others is just as important as being able to manage a process or project well. Conflicts are inevitable, especially when managing a large group of people. Disagreements typically stem from competition, communication gaps, personnel policies and unclear requirements, to name a few. When managed well, a conflicting situation has the potential to bring team members together and make them more focused on achieving the overall objectives of the project. When you are in a leadership or managerial role, one of your main tasks is to inspire. You also need to be able to motivate others if you want them to follow your guidance. Leadership is a never-ending path and the ultimate success on your personal development journey.

Text adapted from:

https://interestingengineering.com/10-essential-skills-that-hiring-managers-look-for-in-engineers

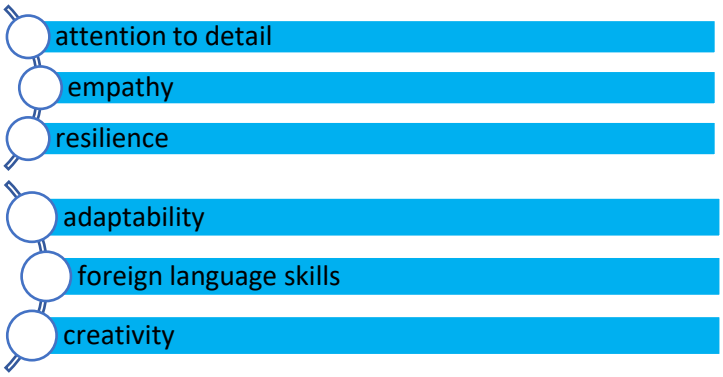
https://towardsdatascience.com/5-soft-skills-you-need-as-a-machine-learning-engineer-and-why-41ef6854cef6

https://www.villanovau.com/resources/project-management/soft-skills-project-managers/

https://www.thebalancecareers.com/list-of-teamwork-skills-2063773

Your turn!

What skills are missing from the text? Which of these should be included?



Now add your own!

Essential skills engineers need to 'make it': Tasks

I. Vocab check! Make sure you know all these expressions.

hard and soft skills
vital and essential
convey technical information

interpersonal skills
have a positive attitude towards circumstances
responsible and accountable for the assigned work
perform to your highest ability
verbal communication and non-verbal cues
time-sensitive tasks
keep deadlines
gain your colleagues' trust convey respect for them
make someone feel appreciated
give honest feedback
analytical mind and critical thinking skills
be a confident problem solver
identify, assess and analyze complex problems
implement solutions to address a problem
handle urgent situations, obstacles and failures
think outside the box
undergo additional technical training
identify and solve arising problems
achieve a result, i.e., success
set your goals and clearly understand your end goal
prioritize the tasks to accomplish the project
be aware of pressure and stressful situations
reward yourself
take responsibility for yourself
you are assigned to lead and handle a team
assess and utilize a member's strength and ability
conflicts are inevitable
disagreements stem from competition
personnel policies and unclear requirements
achieve the overall objectives

II. Look at these soft skills related to communication. How good are you at these skills? Can you think of ways to improve these skills? Be prepared to discuss these soft skills.

Active listening	Public speaking and presentation	Writing skills	Negotiation
Persuasion	Empathy	Patience	Diplomacy
Brainstorming	Adaptability	Self-awareness	Resilience
Respectfulness	Decision Making	Managing your emotions	Humility
Persistence	Team Oriented	Persuading	Flexibility
Logical thinking	Responsibility	Mediation	Helpfulness
Open Mind	Patience	Summarizing	Commitment
Encouragement	Argumentation	Positive Attitude	Sharing Credit

Check out more: https://www.themuse.com/advice/engineers-soft-skills-hiring-managers-want

P.S. Attention to detail matters! Did you notice the mistake?

III. How about not working for someone but being your own boss? Check out this link to find out about entrepreneurs.

https://www.esolcourses.com/content/englishforwork/business-english/vocabulary-quizzes/entrepreneur.html

IV. Making the decision to go freelance is a very personal choice. Considering the arguments of freelancing can help you decide if this is right for you.

Look at these 'pro' and 'con' arguments concerning freelance work. Which is which?

You will ultimately be isolated from a team or company. Unless you have people close to you to work with, often, you will work alone.

Working a freelance job opens the ability to work on a variety of different projects and topics, especially if you thrive in a setting with multiple projects running.

While independent contractors or freelancers can choose to work in an office, they are not as closely overseen as employees, so they are more likely to be based at home, which, for a company, means they don't need to provide office space for them.

Ultimate Responsibility: you're in charge of business development, getting clients, managing your clients, billing/collecting, and paying taxes. You'll need to make many decisions—how you'll track and accept payment (PayPal or similar); which programs you need to purchase (Adobe Suite, Microsoft Office, subscription platforms, etc.); what promotional tools you need (business cards, a website, and even a logo) and more.

Not only are you free of the cubicle and 9-to-5 work life, but you also have the ability to work alone, and for the most part, where you are most comfortable doing so.

If you want to work full-time most of the year and only part-time during the summer, you have the flexibility and control to make that decision.

Freelancers have the responsibility of paying for their own social security package.

Freelancers can not only choose the clients they work with, but they can also choose if they want to work with many or just few clients.

Finding steady work, since promising projects can soon get shelved, or clients may end a contract early, then struggle to find more work.

Because a freelancer or independent contractor is often done on a project basis, there is no guarantee what the hourly rate might be. As a freelancer you are not required by law to receive the minimum Wage.

Ability to choose your workload: you can choose projects that are meaningful to you. You also get to focus on the work you love without the distractions of a full-time job like meetings, office politics, or office distractions.

A freelancer must usually send an invoice to be paid. And if the invoice is not paid on time, it is the contractor who must follow up to ensure payment. And in a few cases clients may never pay at all, which means it falls on the contractor to take legal action or accept being cheated.

Adapted from: **https://www.flexjobs.com/blog/post/pros-and-cons-of-freelance-jobs/**
https://www.thebalancecareers.com/should-you-work-for-yourself-4035267

V. Video for fun: check out this video on the Facebook office in London. Could you see yourself working here?

https://www.youtube.com/watch?v=VhuDhNLatlk&feature=emb_title

VI. Based on the previous video, look at the following sentences. What do you think about these interior design statements?

Studies find that within a workplace that encourages collaborative working, that productivity increases by 15%.

Grade the sentences 1-5: 1 – no way; 2 – I would probably not like/not use this feature; 3 – I don't mind either way; 4 – that sounds really great; 5 – definitely a 'must-have' feature.

grade	statement
	Office space must be easily adaptable using modular office furniture
	The kitchen should have a coffee machine.
	The creative office design should feature transparent meeting rooms.
	A table for table tennis is a must.
	The kitchen space should be in the heart of the working area.
	An open, communal workspace must feature custom-built desks.
	There should be nooks in which employees can work or put your feet up.
	There are rooms to play sports, sing and dance, even get a massage.
	Green plants are just a waste of money and too much work to take care of them.
	A creative office must have loud patterns and a bold, in-your-face design.
	The office should be in painted in bright colors
	The workspace should include a spray paint mural by a professional street artist.
	Ideally, the workspace should have separate cubicle the 'owners' can decorate themselves
	Team members are motivated to change seats each day to encourage impromptu encounters and collaborations
	The workspace must have an indoor slide between the floors.
	In the office there are also futuristic-looking sleeping pods where employees can take a nap.

Bill Gates: How to Avoid a Climate Disaster – The Solutions We Have and the Breakthroughs We Need

Climate change is closely linked to the problem of energy poverty. Today roughly 860 million people don't have electricity. The motto of the Bill & Melinda Gates Foundation is "Everyone deserves the chance to live a healthy and productive life"—and it's hard to stay healthy if your local medical clinic can't keep vaccines cold because the refrigerators don't work. It's also impossible to build an economy where everyone has job opportunities if you don't have massive amounts of reliable, affordable electricity for offices, factories and call centers. We began to think about how the world could make energy affordable and reliable for the poor. But the more we learn about energy poverty, the more we understand the dilemma of energy and climate change: although the world needs to provide more energy so the poorest can thrive, we need to provide that energy without releasing any more greenhouse gases. In fact, we need to eliminate our emissions, all the way to zero.

Some sources of emissions, like electricity and cars, receive lots of attention, but they're only the beginning. The biggest contributor to climate change is manufacturing—making things like steel, cement and plastic—at 31% of global emissions. Second in line is producing electricity, at 27% of emissions; after that comes growing things like crops, at 19%. Transportation comes in fourth, at 16%, followed by the emissions from heating and cooling buildings. These percentages are less important than the overall point: any comprehensive plan for climate change has to account for all the activities that cause emissions, and that's much more than making electricity and driving cars. Unless you're looking across all five areas—how we plug in, make things, grow things, move around, and keep cool and stay warm—you're not going to solve the problem.

It's also crucial to understand how much getting to zero will cost. Right now, the primary reason the world emits so much greenhouse gas is that fossil- fuel technologies are by and

large the cheapest energy sources available. In part, that's because their prices don't reflect the environmental damage they inflict. In other words, moving our immense energy economy from "dirty," carbon-emitting technologies to ones with zero emissions will cost something. These additional costs are what we call Green Premiums. For example, the average retail price for a gallon of jet fuel in the U.S. over the past few years is $2.22. Advanced biofuels for jets, to the extent they're available, cost on average $5.35 per gallon. The Green Premium for zero-carbon fuel, then, is the difference between these two prices, which is $3.13. That's a premium of more than 140%.

How much are we willing to pay to go green? What are the trade-offs? Will we buy advanced biofuels that are twice as expensive as jet fuel or use green cement that costs twice as much as the conventional stuff? This is "we" in the global sense. It's not just a matter of what Americans and Europeans can afford. We need the premiums to be so low that everyone will be able to decarbonize.

In the U.S., electricity is a good example. The Green Premium is the additional cost of getting all our power from non-emitting sources, including wind, solar, nuclear power, and coal- and natural-gas-fired plants equipped with devices that capture the carbon they produce. Changing the entire U.S. electricity system to zero-carbon sources would cost roughly 15% more than what most people pay now. Europe is similarly well situated. There is also an opening for new technologies, companies and products that make it affordable. Countries that excel at research and development can create new products, make them more affordable and export them to the places that can't pay current premiums.

Leaders around the world will need to articulate a vision for how we can lower the Green Premiums and make the transition to zero carbon. That vision can, in turn, guide the actions of people and businesses. Government officials can write rules regarding how much carbon those power plants, cars and factories are allowed to emit. They can adopt regulations that shape financial markets and clarify the risks of climate change to the private and public sectors. States can play a crucial role in demonstrating innovative technologies and policies, such as using their utilities and road-construction projects to introduce technologies like low-emissions cement into the market. Cities can do e.g., buy electric buses and fund more charging stations for electric vehicles. But you don't have to be a policymaker to have an impact. As a consumer—or someone running a business—you can also send a signal to the market that people want zero-carbon alternatives and are willing to pay for them. When you pay more for an electric car or a heat pump, you're saying, "There's a market for this stuff. We'll buy it."

When we have a fact-based view of climate change, we can see that we have some of the tools we need to avoid a climate disaster, but not all of them. We can see what stands in the way of deploying the solutions we have and developing the breakthroughs we need. And we can see all the work we must do to overcome those obstacles.

Adapted from text by Jamey Stillings based on How to Avoid a Climate Disaster: The Solutions We Have and the Breakthroughs We Need by Bill Gates, publishing on Feb. 16, 2021 by Penguin Random House LLC. Copyright © 2021 by Bill Gates.
Text originally published in Time magazine on January 21, 2021
https://time.com/5930098/bill-gates-climate-change/

How to avoid a climate disaster: Tasks

I. Do you know the following terms? Can you explain them in English or give examples?

a fact-based view of climate change
reliable, affordable electricity
so the poorest can thrive
to eliminate our emissions
to prevent a disaster
to release greenhouse gases
the overall point
a comprehensive plan
to account for
it's crucial to understand
by and large
to inflict environmental damage
average retail price
to go green
trade-off
excel at research and development
to articulate a vision
to make the transition to zero carbon
to adopt regulations
to shape financial markets
to play a crucial role
to demonstrating innovative technologies
utilities and road-construction projects
policymakers have an impact
to deploy a solutions
to overcome those obstacles

Not sure about the vocabulary? Here's a list of useful climate-related words and expressions: https://www.esolcourses.com/content/topics/environment/climate-change/climate-change-vocabulary.html

II. Click on this link and watch the video on climate change.

https://en.islcollective.com/video-lessons/climate-change-vocab

Video quiz questions

1) What does **fundamentally** mean?
   a. being an essential part of
   b. being necessary
   c. being required
2) What is a **phenomenon** (in nature)?
   a. something that is surprising in nature
   b. something that has been observed in nature
3) What is a **greenhouse**?
   a. a type of farm house
   b. a warm house for plants to grow
   c. a house where vegetables are grown
4) An "**alarming rate**" is....
   a. an unsurprising rate
   b. a normal rate
   c. a concerning rate
5) What does "**fluctuated**" mean?
   a. to increase
   b. to vary
   c. to decrease
6) What does **shift** mean?
   a. to move
   b. to adapt
   c. to slide over
7) What does "**renewable energy**" mean?
   a. energy that can be used one time
   b. energy that can be reused many times
   c. solar power

III. Choose the best word from the following to complete the sentences below:

impact, precipitation, ecosystem, natural, footprint, emissions, greenhouse, unusual, endangered, fossil

1. If an animal is _____, it is threatened with extinction.

2. A natural community that supports a variety of plant and animal life is known as

an _____.

3. Carbon dioxide, methane, and nitrous oxide are examples of _____ gases.

4. Oil and coal are examples of _____ fuels.

5. Snow, rain, and hail are examples of _____.

6. People concerned about climate change try to minimize their carbon _____.

(= the amount of carbon emitted by an individual or organization in a given period of time)

7. Greenhouse gases releases into the atmosphere are referred to as _____.

8. The _____ (= effect) on the environment has been significant.

9. Climate change manifests itself not only as global warming, but also as extreme and

_____weather.

10. "Man-made" is the opposite of _____.

Taken from: https://www.learnenglishfeelgood.com/vocabulary/climate-change-global-warming2.html

IV. Match the words in the vocabulary list above to their meanings.

adapt, affect, consequences, drought, emissions, flooding, fossil fuels, global, greenhouse gases, hurricanes, impact, increase, precipitation, reduce, region, temperature

A. major tropical storms -
B. effects of an action -
C. rain & snow -
D. an area or part of a country or of the world -
E. to make needed changes to adjust to changing conditions -
F. water suddenly covering areas that are usually dry land -
G. get bigger -
H. make smaller -
I. gases or chemicals released into the atmosphere -
J. make a difference (to something or someone) -
K. extended dry period -
L. energy sources like petroleum, coal, and gas -
M. relating to the whole earth -
N. a major effect -
O. a measure of how hot or cold something is -
P. gases like CO_2 and methane that trap heat and contribute to global warming -

Taken from https://www.englishhints.com/weather-vocabulary.html

V. So how can you reduce your carbon foot print? Here are some ideas.

REFUSE: Avoid single use plastics and paper products by saying no thank you, opting for reusables.
REDUCE: Downsize what you purchase, opting to be more mindful of what you really need.
REUSE: Always find a way to keep an item out of the landfill by keeping it in great condition, repairing or upcycling it when it breaks.
RECYCLE: Properly recycle any plastic, paper, glass or metal that comes into your life you cannot refuse, reduce, or reuse by researching your state's recycling laws.

Your turn: talk about how and why the following ideas will help to 'greenify' your environment.

- BIKE **more and drive less**
- CONSERVE **water and protect our waterways**
- EAT **seasonally, locally, and more plants**
- SWITCH **to sustainable, clean energy**
- DON'T **buy fast fashion**
- SWITCH **lights off and unplug**

For further ideas, check out these sites:
https://www.goingzerowaste.com/blog/5-ways-to-reduce-your-carbon-footprint/
https://blogs.ei.columbia.edu/2018/12/27/35-ways-reduce-carbon-footprint/

Current trends in Industry 4.0

Industry 4.0 trends and technologies are fundamental in achieving connected manufacturing geared towards smart and autonomous factories. The manufacturing sector faces mounting challenges with a major focus on optimizing production and balancing costs. Rapid advancements in emerging technologies such as the industrial internet of things (IIoT), advanced mobile robots, and artificial intelligence-enabled solutions enable companies to tackle these challenges head-on.

Cyber Security, Transparency & Privacy

The importance of cyber security within industry and critical infrastructure cannot be underestimated. Cybersecurity encompasses an array of challenges to protect digital information. A significant data security incident can cripple a company's operations, damage its brand and relationships with customers or clients, expose the company to multiple lawsuits, and require great financial and human resources to address. As the manufacturing practices are increasingly becoming personal and customizable, the data management practices done outside and within the shop floor will hugely influence the appeal of the company. The transmission and processing of sensitive industrial data need to be done securely to avoid cyberattacks on critical industrial facilities. Digital ethics and privacy, privacy-enhancing technologies, self adaptive security, zero-trust security, end-to-end communication security, are some of the new developments in this front that ensure secure flow of information due to the connectedness in Industry 4.0.

Artificial Intelligence

Artificial intelligence and machine learning are changing engineering. Machine learning means machines can learn by taking in data, analyzing it, taking action, and then learning from the results of that action. The aim is for machines to be able to design and improve tasks over time—with little or no human intervention—through machine learning. Robots have been used by automobile manufacturers on the production line for quite some time and have gone from completing simple engineering tasks to now handling many precision moves required for some of the most intricate parts of the process. Factories are integrating AI across their production systems and processes to tackle new challenges facing manufacturing. Advanced AI makes it possible to conduct predictive maintenance, cognitive computing, swarm intelligence, context-aware computing, smart machines, hardware accelerators, and generative design. All of these technologies propel manufacturing facilities to move towards complete lights-out manufacturing.

Human Augmentation & Extended Reality (XR)

The term “extended reality” (XR) refers to all environments that combine real and virtual elements with various levels of interactivity with and between these elements. This includes augmented reality (AR), which superposes virtual 2D or 3D elements onto a real environment, virtual reality (VR), which completely immerses the user in a virtual universe, and mixed reality (MR). XR technologies are already in use in Industry 4.0 from the research and development (R&D) to full-scale production and post-production processes. Making it possible to limit prototypes and physical tests,

the use of virtual prototypes at an early stage of the development cycle reduces design costs and delays, while also optimising product quality. In effect, they provide engineers with the opportunity to compare the performances of different models quicker and to define the best manufacturing processes. In the area of maintenance, digital twins are used to monitor and optimise the running of industrial equipment. As a digital replica of a real system (machine, industrial process, assembly line, or even an entire factory) provided with data that is gathered by IoT sensors, the digital twin provides information on the condition and performance of this system throughout its lifecycle.

Advanced Robotics

Advancements in robotics make the processes in industry 4.0 faster, safer and efficient. The most prominent robotic technologies impacting manufacturing include autonomous robots, collaborative robots (cobots), collaborative autonomous mobile robots, humanoid, mobile robots, cloud robotics, APIs, pick and place robots, and robot swarms. The use of robots offers higher precision and agility while improving the capability of rapidly developing customizable robots. Cobots increase the efficiency of human-performed tasks as they are designed to work alongside the human workforce. Robots also free up time for the human workforce to focus on other non-repetitive or higher-level tasks, such as factory management. For example, *Fanuc LR Mate 200iD* has 6 degrees of freedom with a precision of 0.01 mm and carries up to 7 kg of load within a 0.717-meter reach, with a speed of up to 500 °/s.

Internet of Everything

The machine-machine, human-machine, and human-human real-time connectedness together comprise the internet of everything in manufacturing. It includes IIoT, internet of skills, internet of services, internet of systems, and shop floor IoT. The internet of everything combines together real-time data, machine intelligence, and human skills, resulting in speedier, efficient, and cost-effective manufacturing processes. Interoperability and a unified internet of things framework are crucial for the smooth implementation of industry 4.0 facilities. For example, an Internet of Everything platform for maintenance will replace the time-consuming tasks of paper-based planning, execution, and reporting of maintenance activity. The use of smart connected tools within such platform leads to transparent and traceable records of all maintenance operations. This helps in reducing costs associated with quality control and improving overall productivity.

Additive Manufacturing

Manufacturers are constantly searching for new technologies to cater to all aspects of the growing market demand. Additive manufacturing or 3D printing, is the construction of a three-dimensional object from a CAD model or a digital 3D model. Additive manufacturing started out as a

prototyping technique. The term “additive manufacturing” refers to technologies that grow three-dimensional objects one superfine layer at a time. Each successive layer bonds to the preceding layer of melted or partially melted material. Objects are digitally defined by computer-aided-design (CAD) software that is used to create .stl files that essentially "slice" the object into ultra-thin layers. This process of creating 3D objects from materials such as plastic, metal and concrete, has become an integral part of many industries such as automotive, aerospace, medical and robotics over the last few years. Hybrid manufacturing aims to integrate both additive manufacturing and subtractive manufacturing. The advancement in material science and techniques such as metal 3D printing enables simpler fabrication of intricate structures and complex components. Additive manufacturing is making highly-customizable production a reality.

Big Data & Analytics

The scale of industrial data collection eventually enables factories to make the transition into industry 4.0 facilities. Big data is complex and is valuable only when it is captured, stored, and analyzed in a quick and cost-effective manner. Advancements to utilize data for gaining valuable insights into the manufacturing systems, along with the availability of immediate and real-time data, open up opportunities for prescriptive, predictive, and augmented analytics at different levels of a company’s manufacturing facilities. Such software is capable of predicting product quality outcomes for every production batch and even for single products. Downtimes cause unnecessary losses to manufacturing firms in terms of both money and time. The software performs root-cause analysis on manufacturing units to identify hidden contributors to low productivity and sends alerts to prevent downtime.

Trends in Industry 4.0: Tasks

I. Do you know the following terms? Can you explain them in English or give examples?

fundamental in achieving sg.
geared towards
to face mounting challenges
optimizing production and balancing costs
to tackle challenges head-on
importance cannot be underestimated
to encompass an array of challenges
to damage its brand
to expose to lawsuits
to require financial resources to address the problem
to ensure secure flow of information
with no human intervention
on the production line
the most intricate parts of the process
to conduct predictive maintenance
to propel manufacturing facilities towards lights-out manufacturing
to immerse the user in a virtual universe
research and development
early stage of the development cycle
to reduce design costs and delays

the most prominent robotic technologies
to offer higher precision and agility
non-repetitive, higher-level tasks
6 degrees of freedom
smooth implementation of industry 4.0 facilities
to replace the time-consuming tasks
transparent and traceable records
to cater to all aspects of market demand
each successive layer bonds to the preceding layer of melted material

additive manufacturing and subtractive manufacturing
highly-customizable production.
to gain valuable insights into
to predict product quality outcomes
production batch
to perform root-cause analysis
to identify hidden contributors to low productivity
to send alerts to prevent downtime

II. Click on this link and watch the video on Women in IT, then do the quiz.

https://www.esolcourses.com/ielts/women-in-technology/women-in-technology-listening.html

Do you know the meaning of the word 'STEM'?

Science
Technology
Engineering
Mathematics

III. Let's take a tech test! Find the right answer!

1. Henry F. Phillips patented the Phillips screw and screwdriver in 1936. What does *'patented'* mean?

A. He perfected a process to protect against corrosion.
B. Another word for invented.
C. When you started to manufacture the product.
D. Rights to make, use, and sell the innovation.

2. The panel converts the Sun's energy into a DC electric current. Which of the following is not a similar word for *'convert'*?

A. Revolution
B. Transform
C. Change
D. Alter

3. Another word for implementation is...

A. Integration
B. Configuration
C. Installation
D. Optimization

4. Which word is the odd one out? "Milling machines can perform a number of operations, some very complex, such as *cutting, planing, drilling, and debating*."

A. Cutting
B. Planing
C. Drilling
D. Debating

5. If a CAD engineer asks to see the 'blueprints', he is asking to...

A. See how the image looks on a screen.
B. See the technical drawings.
C. See the new printouts from the plotter machine.
D. Check the shape of the object.

6. AutoCAD DXF (Drawing Interchange Format, or Drawing Exchange Format) is a CAD data file format developed by Autodesk for enabling data interoperability between AutoCAD and other programs. The best antonym (or opposite noun) for *'interoperability'* is.....?

A. Uninteractive
B. Cross-functionality
C. Capacity
D. Incompatibility

7. True or false? Corrosion is the wearing away of metals due to a chemical reaction.

8. To dismantle a machine means...

A. To reinstall the machine.
B. To take the machine apart.
C. To sell the machine.
D. To buy the machine.

9. Which of the following is not a function of a vacuum gripper?

A. It shines.
B. It picks up.

C. It provides suction.
D. It sucks air.

10. When we refer to the *weight* of an object, we are talking about....
A. How high it is.
B. How wide it is.
C. How long it is.
D. How heavy it is.

Check out the original test here:
https://www.proprofs.com/quiz-school/quizshow.php?title=technicalengineering-english-test&q=8

III. Don't like the long technical words? Neither do we, so let's check your knowledge on abbreviations.

ABBREVIATION	FULL VERSION
	alternating current
	asymmetric digital subscriber line
AR	
	American Standard Code for Information Interchange
BCC	
CC	
	closed circuit television
CGI	
	chief information officer/ chief investment officer
CO_2	
CPU	
	chief technology officer
DC	
DM	
ext.	
HDMI	
	hypertext markup language
ICT	
IoT	
(O)LED	
	programmable array logic
PCB	
	polyethylene terephthalate
PVC	
	quality assurance/ quality control
	quick response code

R&D	
rpm	
	small computer system interface
SEO	
	structured query language
	solid state drive
VPN	
	what you see is what you get

Check your results here:
https://www.usingenglish.com/articles/300-technical-english-abbreviations-list.html

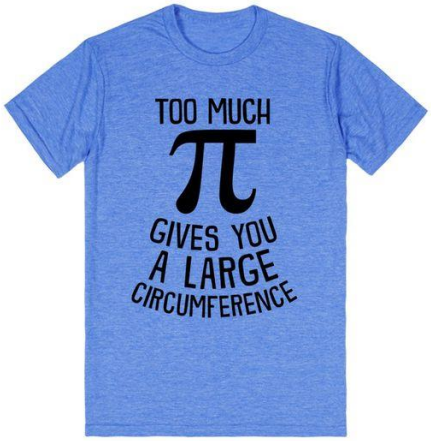
Did you know? *Abbreviation*, in itself, is not an abbreviation, so obviously it is not going to be small, and concise, but more of a broad word. The long word "*abbreviation*" started from the short Latin word *brevis*, meaning short.

IV. All engineers and scientists love numbers, don't they?

Add the mathematical version of these expressions

4 raised to the power of four	
square root of 169	
25 divided by 5	
7 is greater than 4	
4 plus 1 is less than or equal to 6.	
12 is not equal to 15.	
two and one quarter	
five ninths	
three point one four one five nine	
three times X plus four equals sixteen	
triangle with ninety-degree angle	
two thirds (where two is the dividend, and three the denominator)	

V. General science knowledge test: True or false?



T / F: Henry Ford used an assembly line to produce the Ford Model T cars.

T / F: The word π rhymes with 'fee' and 'tree'.

T / F: The development of the light bulb is associated with Thomas Edison.

T / F: The decimal system uses 6 numbers.

T / F: Archimedes was an ancient Roman mathematician.

T / F: Zero was invented independently by the Babylonians, Mayans and Indians.

T / F: The Fibonacci sequence is the basis for the Golden ratio, which was used in architecture and arts in the Renaissance era.

T / F: In 2005 Coldplay released an album under the title 'Speed of light'.

T / F: 'dizzying' is a synonym for 'Mind-bogglingly' in this Douglas Adams quote: "Space is big. You just won't believe how vastly, hugely, mind- bogglingly big it is. I mean, you may think it's a long way down the road to the chemist's, but that's just peanuts to space." (Hitchhiker's Guide to the Galaxy)

T / F: Mechanical engineering is a professional discipline that deals with the design, construction, and maintenance of the physical and naturally built environment, including works like roads, bridges, canals, dams, and buildings.

VI. For book geeks: here are samples from two novels dealing with mathematics.

Excerpt from: Snow Crash by Neal Stephenson (1992) – breakthrough cyberpunk novel

"The dimensions of the Street are fixed by a protocol, hammered out by the computer-graphics ninja overlords of the Association for Computing Machinery's Global Multimedia Protocol Group. The Street seems to be a grand boulevard going all the way around the equator of a black sphere with a radius of a bit more than ten thousand kilometers. That makes it 65,536 kilometers around, which is

considerably bigger than Earth. The number 65,536 is an awkward figure to everyone except a hacker, who recognizes it more readily than his own mother's date of birth: It happens to be a power of 2^16 power to be exact -- and even the exponent 16 is equal to 2, and 4 is equal to 22. Along with 256; 32,768; and 2,147,483,648; 65,536 is one of the foundation stones of the hacker universe, in which 2 is the only really important number because that's how many digits a computer can recognize. One of those digits is 0, and the other is 1. Any number that can be created by fetishistically multiplying 2s by each other, and subtracting the occasional 1, will be instantly recognizable to a hacker."

…

"There are 256 Express Ports on the street, evenly spaced around its circumference at intervals of 256 kilometers. Each of these intervals is further subdivided 256 times with Local Ports, spaced exactly one kilometer apart (astute students of hacker semiotics will note the obsessive repetition of the number 256, which is 2^8 power -- and even that 8 looks pretty juicy, dripping with 2^2 additional 2s). The Ports serve a function analogous to airports: This is where you drop into the Metaverse from somewhere else. Once you have materialized in a Port, you can walk down the Street or hop on the monorail or whatever."

Excerpt from: Smilla's Sense of Snow by Peter Høeg (1992) – thriller novel

"Do you know what the foundation of mathematics is?" I ask. "The foundation of mathematics is numbers. If anyone asked me what makes me truly happy, I would say: numbers. Snow and ice and numbers. And do you know why?" He splits the claws with a nutcracker and pulls out the meat with curved tweezers. "Because the number system is like human life. First you have the natural numbers. The ones that are whole and positive. The numbers of a small child. But human consciousness expands. The child discovers a sense of longing, and do you know what the mathematical expression is for longing?" He adds cream and several drops of orange juice to the soup. "The negative numbers. The formalization of the feeling that you are missing something. And human consciousness expands and grows even more, and the child discovers the in between spaces. Between stones, between pieces of moss on the stones, between people. And between numbers. And do you know what that leads to? It leads to fractions. Whole numbers plus fractions produce rational numbers. And human consciousness doesn't stop there. It wants to go beyond reason. It adds an operation as absurd as the extraction of roots. And produces irrational numbers."

He warms French bread in the oven and fills the pepper mill.

"It's a form of madness.' Because the irrational numbers are infinite. They can't be written down. They force human consciousness out beyond the limits. And by adding irrational numbers to rational numbers, you get real numbers."

I've stepped into the middle of the room to have more space. It's rare that you have a chance to explain yourself to a fellow human being. Usually you have to fight for the floor. And this is important to me.

"It doesn't stop. It never stops. Because now, on the spot, we expand the real numbers with imaginary square roots of negative numbers. These are numbers we can't picture, numbers that normal human consciousness cannot comprehend. And when we add the imaginary numbers to the real numbers, we have the complex number system. The first number system in which it's possible to explain satisfactorily the crystal formation of ice. It's like a vast, open landscape. The horizons. You head toward them and they keep receding. That is Greenland, and that's what I can't be without! That's why I don't want to be locked up."

Tips for writing numbers in text

Dates:

June 30, 1934 (no -th necessary)

For decades using figures, put apostrophe before the incomplete numeral
During the '80s and '90s, the U.S. economy grew.
decades in complete numerals, no apostrophe
During the 1980s and 1990s, the U.S. economy grew.

Writing time of day:

AM and PM are also written A.M. and P.M., a.m. and p.m., and am and pm.
E.g.: 8 AM / 3:09 P.M. / 11:20 p.m. but: 8AM /3:09P.M.

Remember!

In text, you write single-digit numbers (zero to nine) in words; e.g. three hours, five months.
In text, you write multidigit numbers (10 and above) in numerals, e.g. 24 hours.
Do not use numbers at the beginning of sentence; instead say:

Two thousand eight was a challenging year for . . .
The year 2015 saw numerous publications on . . .

Use figures to indicate age, e.g. Tom, Age 38; men in their 40s.

In scientific writing:

If you use numbers larger than 1000, stay consistent!

Use 156000 or 156,000 or 156 000; but do not mix them.

Decide how you write decimals:

0.05 or .05, but not both. Also do not mix: decimal point (0.12) & decimal comma (0,12)

VII. At a glance: decide if the following synonyms mean the same or not, then use them in a sentence

1.  to discuss conditions with the other party in order to make a deal – negotiate
   _____
2.  effect – influence
   _____
3.  show self-assurance – convey confidence
   _____
4.  underline your standpoint - make your point
   _____
5.  be firm and uncompromising - stand your position
   _____
6.  significantly – considerably
   _____
7.  connect with - attach to
   _____
8.  encouraging data – satisfying results
   _____

9.  disregard – ignore

_____

10.  listen carefully - pay close attention

_____

11.  understanding – composition

_____

Focus on technical vocabulary

I. Welcome to technical English! Tell me, what is the correct singular or plural in these sentences?

1. The data **is/are** reliable.
2. The team **have/has** made a great contribution to this project.
3. This **phenomenon / phenomena** is rarely seen.
4. The **radius/radii** of the brass and copper pipes is set at 12 and 18 mm respectively.
5. The following **formulas / formulae** were used in the calculations.
6. The **criterium / criterion / criteria / criterii** has been pre-defined.
7. These **indexes / indeces** lend invaluable insight into functioning of this system.
8. The numbers are distributed in these **matrix / matrices**.
9. This **analysis / analyses** is supported by the following evidences.
10. A number of doctoral **theses / thesis** have been written in this topic.
11. For **millenniums / millennia** these microorganisms have been part of the soil's composition.
12. The improved **syllabuses / syllabi** ensure a better learning experience for students.
13. Numerous **persons / people** choose engineering as a career.
14. The CEO presented several new **schema / schemata** on how to improve profits.
15. **These pieces of information are / these informations are / this information is** important.

Here are some more examples: https://osawec.elc.cityu.edu.hk/repo/front-page/writing-tips/irregular-plurals/

II. Verb or noun? Read these sentences and decide which is the correct version!

1. These devices were set to **communicate – communication** wirelessly with each other.
2. A number of **develops – developers** have worked on this project for more than 6 months.
3. Data **transmit – transmission** was solved using a specialized system.
4. These images were **constructed – construction** from various literary works by this novelist.
5. The **requires – requirements** included the following:
6. Authors are **aware – awareness** of the limitations of this study, therefore further research is needed.
7. This technology will **revolutionize – revolution** the way we use our satellite navigation systems.

8. The scientists won a renowned prize for **innovate – innovation** in the field of bio-informatics.

III. Be nice(ish)! Look at these expressions and tell me if they are nice or just nice-ish. In what situations could you use these expressions with your peers and later, your coworkers?

NICE / NOT NICE	A few buttons missing on his remote control.
NICE / NOT NICE	As bright as a tulip bulb.
NICE / NOT NICE	Brains of a house plant.
NICE / NOT NICE	Can I pick your brains about something?
NICE / NOT NICE	Don't even ask about Steven… his puzzle is missing a few pieces.
NICE / NOT NICE	Engine is running, but no one is behind the wheel.
NICE / NOT NICE	He's as sharp as a bowling ball.
NICE / NOT NICE	He's one beer short of a six-pack.
NICE / NOT NICE	I appreciate you trusting me with added responsibility.
NICE / NOT NICE	I know you were instrumental in saving the company from losing one of its best clients.
NICE / NOT NICE	I'm so impressed with how you handled that meeting/task.
NICE / NOT NICE	I've never thought about the social aspect of this project that way before. You made me see it totally differently.
NICE / NOT NICE	I'm grateful for your taking on the extra work when no one else stepped up.
NICE / NOT NICE	Is there a better time for me to ask you about this?
NICE / NOT NICE	Not the brightest light on the Christmas tree.
NICE / NOT NICE	Not the sharpest knife in the kitchen.
NICE / NOT NICE	Room temperature IQ.
NICE / NOT NICE	Some pixels short of an image.
NICE / NOT NICE	That document is as useful as a chocolate tea pot.
NICE / NOT NICE	Tom is not the sharpest pencil in the pencil box.
NICE / NOT NICE	Useful as a concrete canoe.
NICE / NOT NICE	We got no answer from him. Light is on, but no one at home.
NICE / NOT NICE	What you have brought to this department has been invaluable.

NICE / NOT NICE	You ask such insightful questions that highlight the hidden potentials of this projects, that's great.
NICE / NOT NICE	You included Pete on the team? Wow, you do know he's not the brightest star in the sky, don't you?
NICE / NOT NICE	Your last-minute idea was a game changer.
NICE / NOT NICE	Your skills made this project come together.
NICE / NOT NICE	You've gone above and beyond this week.

IV. Want to be not-so-nice? Do this matching exercise 😊

"He's not playing with a full deck."

CONNECT THIS	WITH THIS
1. He has one brain cell,	a. depth in a parking lot puddle.
2. One sentence short	b. this would be an airport.
3. If idiots could fly,	c. not much furniture.
4. Thinking isn't your	d. on the Christmas tree.
5. He's so stupid, when he threw	e. this job was his car.
6. The only thing he brought to	f. of a sonnet.
7. A few pixels short	g. and almost as intelligent.
8. Nice house but	h. of an image.
9. Not the brightest light	i. of a paragraph.
10. A couplet short	j. strong suit, is it?
11. He would be out of his	k. a rock at the ground and missed.
12. You are as strong as an ox	l. and it is fighting for dominance.