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ENGLISH FOR ENGINEERING

(AEROSPACE ENGINEERING, MECHANICAL ENGINEERING, ENERGY AND UTILITIES, MANUFACTURING, MATERIALS)

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Contents

Forward

This world wouldn't have been the same without engineering as engineering from a simple cog to a huge bearing sets off unimaginable forces that humanity has learnt to harness. And this book by every exercise and every activity extols its achievements in an attempt at revealing its importance and at spurring professionals' interest in building on their English skill. It goes without saying that to know engineering is vital, but to know engineering in English is the epitome of one's aspirations to an integrative role into an world-wide engineering community.

This book is addressed to English intermediate professionals who may need to improve their English knowledge and it offers a satisfying journey along five significant domains in engineering that will strengthen their control of technical vocabulary in a wide variety of exercises. The book encourages vocabulary extension by exercises that deal with synonyms, fill-in exercises which aim at bracing the comprehension of the logic of the text, matching exercises that stimulate particular understanding of concepts, multiple choice exercises that prompt professionals to associate words in verbal phrases, in idioms, etc. Every exercise has at least a twofold purpose: that of instructing the professional with the information that the text provides and that of offering language and vocabulary practice in order to stabilise and improve their English knowledge. There is a key at the end of the book which provides solutions for most of the exercises. At times, the solutions provided are limited to a reduced number of possibilities, yet, others are equally possible, especially in the exercises where the professionals are invited to give full rein to their technical knowledge.

In the first chapter 'Aerospace engineering' the exercises focus on the structure of an aeroplane, on the beginnings of flight, on the physical explanation of the flight (forces), on the airport infrastructure, on flying dangers, flying phraseology, on jobs in this domain and on the relationship between flight and the environment.

In the second chapter 'Automotive engineering' great attention has been paid to the components of vehicles, to traffic issues, to road structure and to the rather harmful effect that vehicles have on the environment.

In the third chapter 'Energy and utilities' the focal point is represented by the extraction of various natural resources with their catalytic effect on industry and harmful effect on nature, with their shortcomings in extraction and use. The chapter takes a special interest in less harmful types of energies that need intensive supervision such as nuclear energy which is presented with its ups and downs. Equally, the chapter brings into

discussion some natural types of energy such as the wind energy and the geothermal one highlighting their insufficient exploitation.

In the fourth chapter, 'Manufacturing' is presented as an innovation that has gradually led to the modern industrial world which could not be better represented than in a production line. A modern concept of 'outsourcing' is equally taken into discussion as it has had a great impact on the development of the western world. An important part of the chapter is dedicated to robots and to the progressive evolution of the industry from the Industrial Revolution to something that is currently called 'Industry 4.0'.

The last chapter 'Materials' encapsulates the history of materials in the history of humanity and claims that humanity wouldn't be today what it is if it hadn't been for its apprehension for the importance of materials to its development. The chapter focuses on some of the most important materials: paper, wood, ceramics and on the impact they had on the human society.

Though a book that is meant to help professionals improve their English technical skills, it similarly tries to transform what could otherwise be some tedious vocabulary exercises into a story that intertwines human skills with curiosity, interest, resistance to failures to reveal the rough, but beautiful history of human love for engineering. And all this happens in English which stands both as a purpose and a means to doing it.

Braşov

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I. Aerospace engineering

1. ***Read the text below about aerospace engineering.***

Aerospace engineering is the field of engineering associated with the design, development and manufacturing of both aircraft and spacecraft. It actually has two overlapping branches: aeronautical and astronautical engineering. The former refers to aircraft piloted within Earth's atmosphere and aeronautical engineers focus on planes, helicopters, and other aircraft that fly within the atmosphere. They design new aircraft, and then test those designs to maximize efficiency and functionality. They study how aircraft work and how they can be improved (in terms of propulsion, construction materials, and more), while the latter refers to spacecraft piloted outside the Earth's atmosphere. Astronautical engineers focus on spacecraft, such as rockets and satellites. They study the performance and design of these crafts inside the earth's atmosphere, as well as beyond it. The two types of engineers encounter different and distinct challenges in their fields. There is, however, a large degree of overlap between aeronautical and astronautical engineering, since they both strive to overcome challenges set by the laws of physics. Space exploration, aviation, and national defence systems all use sophisticated technologies which were developed by aerospace engineers. These engineers typically focus on a specialty like robotics; structural design, instrumentation, propulsion, communication or navigation. Some aerospace engineers design new products like missiles, rockets, military and commercial aircraft, remotely piloted planes and helicopters, and spacecraft. The people who design satellites, air and space vehicles, and missiles are called aerospace engineers. Aerospace engineers create new designs, and then test those designs to ensure they work properly. An aerospace engineer's expertise may include thermodynamics, propulsion, aerodynamics, celestial mechanics, acoustics, flight mechanics, and guidance systems. (adapted from https://monroeaerospace.com)

2.

3. ***Find in the text words which correspond to the following definitions. The first has been done for you.***

1. the first out of two _____the former ___
2. the second out of two _____
3. correctly, as they should _____
4. from distance _____
5. knowledge/ experience _____
6. to increase _____
7. completion _____
8. defiance _____
9. to make efforts _____
10. to defeat _____

4. ***Read the text carefully and fill in the gaps with the correct words. The first has been done for you.***

ever	compromise	~~design~~	cancelled	expertise
supporting	responsible	supervised	integration	risk

The (1) ___design____ of a flight vehicle is a complex and time-consuming procedure requiring the (2) _____ of many engineering technologies. (3) _____ teams are formed to provide (4) _____ in these technologies, resulting in a completed design that is the best (5) _____ of all the engineering disciplines. Usually the support teams are (6) _____ by a project engineer or chief designer for technical guidance and by a program manager (7) _____ for program budgets and schedules. Because of the (8) _____ -increasing requirements for advanced technology and the high cost and high (9) _____ associated with complex flight vehicles, many research and development programs are (10) _____ before completion.

(adapted from https://www.britannica.com/technology/aerospace-engineering)

5. ***Match the words on the left to their corresponding definitions on the right. The first has been done for you (1. f).***

1. fuselage	a. the rear part of an airplane or airship, usually comprising the stabilizer, elevator, vertical fin, and rudder
2. wing	b. the engine, motor, or other power source along with related ignition, transmission, components of a vehicle, aircraft, machine, etc.
3. empennage	c. a device for stabilizing an aircraft, as the fixed, horizontal tail surface on an airplane
4. landing gear	d. a movable control surface attached to a vertical stabilizer, located at the rear of an airplane and used, along with the ailerons, to turn the airplane
5. power plant	e. a thin, flat or curved, extended section of an airplane or a hydroplane, affording a supporting surface
6. cockpit	f. the main body of an aircraft
7. stabilizers	g. a projecting spout, terminal discharging pipe as that of a hose
8. rudder	h. the wheels, floats, of an aircraft, upon which it lands and moves on ground or water
9. flap	i. horizontal structures that stick out from the side of an aircraft and support it when it is flying
10. exhaust nozzle	j. a space, usually enclosed, in the forward fuselage of an airplane containing the flying controls, instrument panel, and seats for the pilot and co-pilot or flight crew

6. ***'Over' is a word that can have several functions. Thus, it can be a preposition, an adjective, an adverb phrase, an adverb, or a prefix. Read carefully each sentence and decide what function 'over' has got in each case. The first one has been done for you.***

1. We need to go ***over*** the street in order to buy sweets for the children. _ preposition _
2. Their patience is ***over***, so you can't do anything about it. _____
3. They tried to contact her ***over and over*** again, but all their efforts failed. _____
4. A flight of geese used to fly ***over*** the river every morning. _____
5. His parents couldn't accept the situation and he couldn't cope with their ***over***reactions. _____
6. I would like you to come ***over***, but I am too busy currently. _____
7. Although the film was ***over***, they couldn't stand up and leave due to fear. _____
8. He tried to improve his English skills ***over*** the summer. _____
9. I strongly believe that the new mall is for sure ***over***priced. _____
10. The plane flew ***over*** and spread the manifestoes to the protesters. _____

7. ***This exercise introduces some apparatuses that are regularly used in planes. Match each apparatus to its corresponding actions. In some cases an apparatus may match more than one action. The first has been done for you (a. 4, 8).***

a. an altitude indicator
b. a tachometer
c. a torque meter
d. a pressure ratio indicator
e. a machmeter
f. a yoke
g. a stick shaker
h. a propeller

1. it usually displays the revolutions per minute (RPM) on a calibrated analogue dial
2. it is a device with a rotating hub and radiating blades that are set at a pitch to form a helical spiral
3. it provides an indication of engine power in the form of the ratio of exhaust total pressure to intake total pressure
4. it informs the pilot of the aircraft orientation relative to Earth's horizon
5. it is a device (available in some hydraulic aircraft) that is attached to the control column, which shakes the control column when the aircraft is about to stall
6. it is an instrument measuring the rotation speed of a shaft or disk
7. it is a device used for piloting some fixed-wing aircraft.
8. it gives an immediate indication of the smallest orientation change
9. it is an aircraft pilot-static system flight instrument that shows the ratio of the true airspeed to the speed of sound
10. it is a device designed to determine the torque or torsion in a shaft, usually by measuring the twist in a calibrated length of shafting

8. ***The activity below is a fact file fill-in exercise about the black box in planes. Read the text as it is given and decide what information is missing. Think about the possible answers, check some reliable sources if necessary and fill in the missing information. The first one has been done for you.***

The black box fact file

General information

- The black box can withstand temperatures of 1. ____ 1800 _____ degrees Fahrenheit.
- The purpose of a black box is 2. _____ of the airplane's all-important flight data.
- It stores the audio conversation between the pilots and the radio communication between the plane and 3. _____ .
- It basically keeps a log of anything else you need to figure out 4. _____ a plane went down.
- All that data can easily recreate what 5. _____ during a flight.

Technical specifications

- And it's all stored on a 6. _____.
- The black box has an 7. _____, thick metal exterior that hides different layers of protection and insulation.
- There's a hard, clay-like 8. _____ layer.
- There's also a 9. _____ green cushion on the inside.
- Both layers are designed to 10. _____ the precious chip.

9. ***The inside of the plane is known as the aircraft cabin. This activity tests your knowledge related to the components of the cabin. You are asked to define these components. You can check the definition at the back of the book. The first one has been done for you.***

1. armrest • ____ a padded or upholstered arm of a chair or other seat on which a sitter can comfortably rest their arm __
2. aisle • _____
3. tray-table • _____
4. reading light • _____
5. air vent • _____
6. overhead locker • _____
7. lavatory • _____
8. headrest • _____

9. life vest pouches
10. literature pockets

- _____
- _____
- _____
- _____

The history of flight

10. Read this text which is about the first flying attempt of the Wright brothers. As you read, fill in the gaps with the appropriate prepositions. The first has been done for you.

Always working 1._____ on _____ different mechanical projects and keeping up 2. _____ scientific research, the Wright brothers closely followed the research of German aviator Otto Lilienthal. When Lilienthal died in a glider crash, the brothers decided to start their own experiments 3. _____ flight. Determined to develop their own successful design, Wilbur and Orville headed to Kitty Hawk, North Carolina, known for its strong winds. Wilbur and Orville set 4. _____ work trying to figure 5. _____ how to design wings for flight. They observed that birds angled their wings 6. _____ balance and control, and tried to emulate this, developing a concept called 'wing warping'. When they added a moveable rudder, the Wright brothers found they had the magic formula. 7. _____ December 17, 1903, they succeeded 8. _____ flying the first free, controlled flight of a power-driven, heavier than air plane. Wilbur flew their plane 9. _____ 59 seconds, 10. _____ 852 feet, an extraordinary achievement.

(adapted from: http://www.history.com)

11. For each gap choose one of the four words (A, B, C, D) that best fits the context. The first has been done for you.

The first man-made objects to fly were balloons, which were 1. ____ pioneered _____ in France by the Montgolfier brothers in 1783. 2. _____ of the basic scientific principles of 3. _____ -than-air flight were laid 4. _____ in England in the early 19th century by Sir George Cayley. In the 1890s Otto Lilienthal of Germany became the first person to make and fly successful gliders. The American brothers Wilbur and Orville Wright were inspired by Lilienthal and 5. _____ 1902 had developed a fully practical biplane (double-winged) glider that 6. _____be controlled 7. _____ every direction. 8. _____ a small engine and two 9. _____ to another biplane, the Wrights on Dec. 17, 1903, made the world's first successful man-carrying, engine-10. _____, heavier-than-air flight at a site near Kitty Hawk, on the coast of North Carolina.

(adapted from https://www.britannica.com/technology/aviation)

1.	A. developed	B. pioneered	C. made	D. set up
2.	A. some	B. neither	C. any	D. all
3.	A. flimsy	B. stronger	C. lighter	D. heavier
4.	A. up	B. down	C. along	D. in
5.	A. before	B. in	C. by	D. after
6.	A. will	B. should	C. could	D. must

7.	A. in	B. at	C. towards	D. to
8.	A. setting	B. mending	C. adjusting	D. fitting
9.	A. boards	B. pilots	C. propellers	D. handles
10.	A. led	B. powered	C. driven	D. managed

12. ***Circle the odd one out. The first has been done for you.***

(seagull)	hot air balloons	airships	gliders
drag	lift	thrust	propulsion
takeoff	tiptoeing	landing	cruising
landing gear	radar	chassis	fuselage
stabilizer	wing	rudder	tailplane
monoplane	biplane	quadruplane	bush plane
effective	efficient	affective	effectual
methane	carbon-dioxide	oxygen	nitrogen
compressor	combustor	turbine	battery
sonic net	transonic	supersonic	subsonic

13. ***Match in pairs the following words (one British and its American counterpart) and fill in the table with the newly formed pairs according to the category they belong to. The first has been done for you.***

gearshift	elevator	lorry	trunk	aeroplane	luggage van	lift
flyover	truck	gear lever	overpass	airplane	windshield	right triangle
aerofoil	luggage car	right-angled triangle	windscreen	boot	airfoil	

British

_ aeroplane _____

American

_ airplane _____

14. ***The text below is a reflection of Leonardo da Vinci's ideas about flight. Read the text and by derivation obtain the words that fill in the gaps in the text. The first one has been done for you.***

Among the many subjects Leonardo studied, the possibility of human mechanical 1. ___ flight _____ held particular 2. _____. He produced more than

(1) FLY
(2) FASCINATE

35,000 words and 500 sketches dealing with flying machines, the nature of air, and bird flight. Leonardo's interest in flight has 3. _____ from his extensive work on military technology which he performed in the employ of the 4. _____ court. Most of Leonardo's aeronautical designs were ornithopters, machines that employed 5. _____ wings to generate both lift and 6. _____. In the Codex, da Vinci discusses the crucial concept of the relationship between the centre of gravity and the centre of lifting 7. _____ on a bird's wing. He explains the behaviour of birds as they ascend against the wind,8. _____ the modern concept of a stall. Leonardo makes 9. _____ observations of gliding flight by birds and the way in which they balance themselves with their wings and tail. He notes the importance of 10. _____ structures that aircraft would require. He even hints at the force Newton would later define as gravity.

(3) STEM
(4) MILAN
(5) FLAP
(6) PROPEL
(7) PRESS
(8) FORESHADOW
(9) INSIGHT
(10) WEIGHT

(adapted from https://airandspace.si.edu/stories/editorial/leonardo-da-vinci-and-flight)

15. ***Derive these verbs that are related to the domain of aerospace engineering in order to obtain nouns. The first one has been done for you.***

1. to fly → _____flight_____
2. to propel → _____
3. to invent → _____
4. to accelerate → _____
5. to navigate → _____
6. to take off → _____
7. to land → _____
8. to intercept → _____
9. to enhance → _____
10. to perform → _____

16. ***These idioms contain the verb 'to fly' or derived forms of the verb. Match the idioms to the contexts where they best fit. Change anything that you consider necessary in order to obtain correct sentences. The first one has been done for you (1 - j)***

1. Fly by
2. On the fly
3. Fly by the seat of your pants
4. Sparks fly

a. A normally soft-spoken man, he is known to _____ if things don't go his way.
b. This is an argument that seems to _____ common sense.
c. He wants to work from home full time, but _____ with the bosses.
d. _____ when he arrived late for her special dinner.

5. Fly in the face of	e. I asked my boss if I could go on a two month vacation, he said yes, _____ !
6. Fly into a rage	f. I had no idea how to do it – I was just _____ .
7. It'll never fly	g. He's gone back to driving school in an effort to _____ .
8. When pigs fly!	h. I invented a tale _____ about writing a magazine article about some of the more humorous entries.
9. Pass with flying colours	i. He also insists that it won't be a _____ operation, that his commitment to the community is lasting and genuine.
10. Fly-by-night	j. Don't you find that Sunday just _____?

17. Read the following text on planes' wings and answer the questions. The first one has been done for you as a model.

The wing is shaped and tilted so that the air moving over it travels faster than the air moving underneath. When moving air flows over an object and encounters an obstacle (such as a bump or a sudden increase in wing angle), its path narrows and the flow speeds up as all the molecules rush though. Once past the obstacle, the path widens and the flow slows down again. If you've ever pinched a water hose, you've observed this very principle in action. By pinching the hose, you narrow the path of the fluid flow, which speeds up the molecules. Remove the pressure and the water flow returns to its previous state. As air speeds up, its pressure drops. So the faster-moving air going over the wing exerts less pressure on it than the slower air moving underneath the wing. The result is an upward push of lift. In the field of fluid dynamics, this is known as Bernoulli's principle. In general, the wings on most planes are designed to provide an appropriate amount of lift (along with minimal drag) while the plane is operating in its cruising mode. However, when these airplanes are taking off or landing, their speeds can be reduced to less than 200 miles per hour (322 kilometres per hour). This dramatic change in the wing's working conditions means that a different airfoil shape would probably better serve the aircraft. Airfoil shapes vary depending on the aircraft, but pilots further alter the shape of the airfoil in real time via flaps and slats. During takeoff and landing, the flaps (on the back of the wing) extend downwards from the trailing edge of the wings. This effectively alters the shape of the wing, allowing it to divert more air, and thus create more lift. The alteration also increases drag, which helps a landing airplane slow down, but necessitates more thrust during take-off. (adapted from https://science.howstuffworks.com)

1. How is a wing that is tilted?
   __ A wing that is tilted is slightly angled. _____
2. How is the air that moves over the wing by comparison to the one that moves underneath?
   _____
3. What is the role of an obstacle on the speed of a plane?
   _____