Guess what does "breaking point" mean?

= the stage at which your control over yourself or a situation is lost.

Did you recently experience a technical problem, either at work or at home?

If yes, give a brief description.

Look at these videos
http://www.youtube.com/watch?v=O6pgnryeC5g
http://www.youtube.com/watch?v=R63CTWfByLU

Do task 1.

Le Mans

Tasks 2a & 2b should be done, at home, before the lecture.
**Answers (2a)**
1 To finish first, first you must finish
2 Engineering enemies
3 Wear and tear

**Answers (2b)**
1 heat 4 shocks
2 pressure 5 abrasion
3 vibration

**Do task (2c)**
**Answers**
1 shocks 6 abrasion
2 heat 7 shocks
3 abrasion 8 pressure (caused by heat)
4 shocks 9 vibration
5 abrasion

**Extension activity: automotive parts**
How the parts listed in Exercise 2c would be different in a racing car compared with a road car.
Answers

1. **chassis** = much stiffer so that it doesn’t twist due to high loads during cornering.

2. **engine** = much more powerful, able to rev much higher.

3. **gearbox** = has an electronically controlled semi-automatic gearbox controlled by paddles on the steering wheel, able to make much faster gear shifts and possibly seamless shifts where there is no interruption in power delivery during gear shifting.

4. **clutch** = much stronger as required to cope with sudden power delivery.

5. **suspension** = is the term given to the system of springs, shock absorbers and linkages that connects a vehicle to its wheels and reduces the uncomfortable effects of going over uneven road surfaces and to better cope with cornering forces and vertical load generated by down force from wings.

Look at this video

http://www.youtube.com/watch?v=L0R5eiR6nck
5. **brakes** = need to cope with much greater loads and operate at much higher Temperatures.

6. **tyres** = in dry conditions slick (smooth) tyres are used instead of grooved tyres, to maximize the contact patch – the amount of rubber in contact with the road surface. *(Look at the picture of grooved tyres in the web site)*

7. **wings** = specific to racing cars.

8. **cooling system** = most racing cars do not have a fan to blow air over their radiators when the car is stationary, meaning they must be moving to benefit from the effects of air cooling; hence they may only remain standing for a very short time, to avoid overheating.

9. **nuts and bolts** = stronger and lighter, with better resistance to working loose due to vibration.

**Do tasks 3a,3b,3c,3d & 3e at home**

**Note:**

- **A chicane /ʃɪˈkeɪn/** is a piece of road with severe bends like an 'S', which forces drivers to go more slowly, especially in motor racing.
• At a full throttle = as hard as possible.
• Crucial= extremely important or necessary.

Do task 3b
Answers

1 blocking 3 bend; snap
2 jam 4 crack

Do task 3c
Answers

1 leaking out 4 clog up
2 run out 5 wearing out
3 cut out 6 blow up

Do task 3d at home.
Do task 3e
Answers

2 leaking out 6 blocked (up)
3 jammed 7 bent
4 clogged up 8 worn out
5 worked loose 9 run out

NOTE
rugged= uneven
drag= pull
grip= control

Look at this video
http://www.youtube.com/watch?v=f4pILqhwYE
Do task 4

Answers
Monza has long straights and several chicanes. This means cars are at full-throttle for longer, and need to do a lot of heavy braking. Problems: engines can overheat and blow up; brakes can overheat; riding the kerbs can cause the suspension to crack, bend or snap; the right-hand corners cause the tyres on the left of the car to wear out faster than those on the right side; and leaves can block up the radiators.

Assessing and interpreting faults

Do task 5a

• assessing = evaluating, examining, making judgments
• interpreting = understanding, reaching conclusions
• troubleshooting = solving problems

What are the most effective ways of solving technical problems?
1. identifying possible causes
2. eliminating possibilities
3. using a process of elimination

Do task 5b

Answers

- User’s observations = what the person using the machine has noticed
- Nature of fault = type of problem
- Circumstances of fault = in what type of situation the fault happened/happens
- External factors = things from outside, for example the weather or something hitting the machine
- Process of elimination = thinking of possible problems and deciding which are not possible in order to reduce the number of possibilities
• Identify the fault = find the fault / decide what the fault is
• Determine action and urgency = decide what to do about the problem and decide how quickly it needs to be done

Do task 6a at home
Do task 6 b

Answers
1 defect
2 defective; faulty
3 major
4 minor
5 properly
6 intermittently
7 systematically

Extension activity: more vocabulary
• warning message = an electronic display which describes a problem by displaying a text message
• fuel injection system = a device in an internal combustion engine (a petrol/gasoline or diesel engine) which injects vaporized fuel = an explosive mixture of fuel and air into the piston cylinder where it subsequently explodes, driving the piston downwards.
(see videos: fuel injection & piston motion)
• **sensor** = a detecting/measuring device, for example a *heat sensor* or a *pressure sensor*.

• **misfiring** = when an engine is not running smoothly due to a fuel or ignition problem.

• **refuel** = fill up with fuel.

• **tank** = a *tank* is a static container for storing liquid outdoors or indoors or is part of a vehicle.

- oil tanker
- flying tanker
- tanker

• **tanker** = a vehicle with a large tank on it which is used for transporting liquids in bulk.

• **fuel pre-heater** = a device in a diesel engine which heats up the fuel to be injected into the piston cylinder as the engine is started, allowing the vaporized fuel to explode more readily in the piston cylinder thus allowing the engine to
start more quickly, it’s just one of the pre-heater plugs that’s *gone*.

- **gone** = a general term to describe components that have failed ‘at the next service’.
- **service** = planned maintenance

*Do this exercise*

**Match the words (1–9) and the definitions (a–h).**

1 temp. gauge
2 radiator
3 electrical contact
4 starter motor
5 manufacturing defect
6 override
7 water pump
8 fan
9 distribution belt

**Distribution belt (timing belt)**

- **a** an electric motor used to turn over an internal combustion engine in order to start the engine
- **b** a belt in a diesel engine which connects several pulleys in order to turn different engine devices in a synchronized manner – if this belt fails suddenly, fuel will be injected into the piston cylinders when the
pistons are in the wrong positions, and the subsequent unsynchronized explosion can cause serious damage to the engine
c temperature gauge – a display which shows the temperature of the cooling water circulating in the engine
d an automatic system which takes over in order to prevent a problem when a manual system is operated improperly, for example in antilock braking systems (ABS) on cars, if the driver brakes too hard, causing the wheels to lock, the ABS will automatically control the brakes through a software control system
e situated in front of the radiator, this is activated to blow air over the radiator and keep the water cool
f moves water around the engine block to cool it
g at the front of the vehicle, this dissipates (cause to) gradually disappear or waste, the heat from the water into the air. When the vehicle is moving, air flows over it providing the required cooling effect - but when the vehicle is stationary(not moving) and the engine is still running, for example in a traffic jam, as there is no airflow, there is a danger that the water will become too hot and boil.
h physical connection between two electrical conductors, for example the connection between the end of a wire and a component
j a problem or fault with a component due to a problem when it was manufactured – not a problem that has occurred due to wear

Answers
1 c  2 g  3 h  4 a  5 j
6 d  7 f  8 e  9 b

Do task 6 c

Answers
1 b  2 c  3 a

Do task 6 d

Suggested answers
1 This is an intermittent problem. It’s probably caused by wear and tear.
2 This was a sudden problem. It’s probably a faulty part, or an installation problem.
3 This is a systematic problem. It’s probably a faulty part, or an installation problem.

Do task 6 e

Answers
2 It sounds like it’s  4 I doubt it’s
3 It could be / It might be  5 It can’t be

Look at the meaning of the following terms.
• **dump truck** = a large off-road truck used for carrying heavy loads of earth, rocks or minerals.
• **quarry** = a large hole in the ground (an *opencast mine*) from which minerals are dug.
• **down on power** = has less power than it normally should.
• **fuel consumption** = the rate at which fuel is used.

Do task 7a

**Answers**

minor; systematic

Do task 7b

**Suggested answers**

• It can’t be water in the fuel supply. (This would cause misfiring.)
• It could be a clogged fuel filter. (The engine is performing consistently, but is down on power.)
• I doubt it’s a compression leak. (This would probably result in increased fuel consumption, and would probably cause more major problems.)
• It can’t be a lubrication problem. (This would cause overheating.)
• I doubt it’s a blockage in the exhaust system. (This would cause more major problems.

Do task 8

Answers
1. checklists = lists of things to be checked
2. standard procedures = specific, planned ways of dealing with situations and problems.
3. back-uinstallations=secondary/additional equipment that will work if main equipment fails.
4. planned maintenance = replacing parts at planned times even if they are not worn out.

Look at the meaning of the following terms
• hydraulic pipe = high-pressure oil pipe, used to push pistons called hydraulic rams
• fuel line = fuel pipe/hose
• ruptured/rʌptərd/ = broken/cracked
• gliding = flying without power

Do task 9a

Answers
1 An incorrect (oversized) hydraulic pipe was fitted to the right-hand engine.
2 The pipe rubbed against a fuel line.
3 The fuel line ruptured, resulting in a major leak.

Do task 9b

Answers

04:58 b 05:36 d 06:13 a 06:27 c

Do task 9c

Answers

2 oversized 7 disproportionate
3 inadequate 8 irregular
4 undetected 9 imbalance
5 abnormal 10 malfunction
6 insufficient 11 inoperable

Do task 9d

Answers

1 incorrect/abnormal 5 malfunction
2 inadequate/insufficient 6 imbalance
3 irregular 7 undetected
4 oversized 8 inoperable

Extension activity: more vocabulary

Look at the meaning of the following terms

flight data recorder = a digital device which records essential data on an aircraft
(instrument readings etc.) which can be analyzed by air accident investigators – often referred to as a black box.

**landing gear** = the wheels of an aircraft

**ram air turbine** = A ram air turbine (RAT) is a small airflow driven engine that supplies emergency electrical or hydraulic power to aircraft, it's a propeller-like device which spins when placed in an airflow.

**fly-by-wire** = (is a system that replaces the conventional manual flight controls of an aircraft with an electronic interface. The movements of flight controls are converted to electronic signals transmitted by wires) flight controls operated electronically (connected by electrical wires) rather than by mechanically operated tension cables like those used to operate bicycle brakes.

*(Video see "plane flaps")*

**flaps** = aerodynamic devices on the backs of aircraft wings used to increase the amount of lift generated by the wings in order to allow the aircraft to take off and land at reduced speed.

*(Video see "plane spoilers")*
**spoilers** = aerodynamic devices on the tops of wings, used to generate drag and down force in order to slow the aircraft down during descent and just after landing—also called *air brakes*.

**cross-feed valve** = valve allowing fuel to be fed from one tank to another

Do tasks 10a & 10b at home  
Do task 10c

**Answers**

In general, insufficient tyre pressures could be caused by:

1. pressure loss over time (all tyres lose air pressure progressively over a period of several months) due to inadequate maintenance;
2. a slow puncture (air leaking slowly from a small hole in the tyre);
3. air leaking from a valve due to a problem with the valve, for example dirt in the valve preventing it from closing properly;
4. a faulty pressure gauge on the compressor used to inflate the tyres, giving an incorrect pressure reading. With this specific problem, perhaps there was a
fault with the compressor used to inflate that block of tyres – a different compressor to the one used to inflate the other blocks – and this gave the maintenance technician an incorrect pressure reading when inflating that block of tyres. It’s unlikely that a technical problem with the tyres, such as slow punctures or leaking valves, would occur on several tyres at the same time and cause exactly the same loss in pressure across all the tyres.

**Discussing repairs and maintenance**

**Points for discussion**

1. *preventive/preventative maintenance*
   
   This involves attributing *life-spans* to components (planning how long they are able to function effectively and safely), and thus prescribing when they need to be replaced. This is to avoid breakdowns by replacing parts in time.

2. *sealed units / non-serviceable parts* whose internal components cannot be repaired or replaced on site, requiring replacement of the complete unit, or requiring the unit to be sent back to the manufacturer.
Do task 11a

Suggested answers

- Repairs are done to correct technical problems after breakdowns have occurred.
- Maintenance is done to prevent technical problems from occurring.
- Broken = repair, for example a bolt that has broken
- Clogged (blocked) = repair, for example a filter that is completely clogged and has caused a technical problem; or maintenance, it is slightly clogged and is ready to be replaced
- Defective = repair, for example a part that was incorrectly manufactured and did not work
- Faulty = repair, for example a sensor that is giving incorrect measurements
- Worn = maintenance, for example worn tyres need to be replaced

Do task 11b

Suggested answers
Similarities: parts and fluids are replaced on a planned maintenance programme, parts are checked visually for wear and damage, and that they are tightly fixed, correctly aligned/balanced, etc.
Main difference: standards in aviation are more rigorous (strict)
Extension activity: more vocabulary
Look at the meaning of the following terms
access panel = bodywork part designed to be removed to allow technicians to reach internal parts.
filter = material with small holes located in a flow of gas or liquid, used to block solid particles, for example to prevent them from damaging a sensitive mechanism such as a pump
Do task 12a
Answers
2 d  3 c  4 a  5 g  6 b  7 j  8 e  9 h  10 i
Do task 12b

**Answers**

2. d  
3. j  
4. g  
5. c  
6. b  
7. i  
8. a  
9. h  
10. e

Do tasks 13a, 13b & 13c at home

**Extension activity: more vocabulary**

*Look at the meaning of the following terms in Exercise 14a.*

**external visual inspection** = looking at the machine without dismantling (taking apart) anything.

**alignment** = whether things are in line, parallel with each other.

**earthing** = when electricity flows between a source of current and the ground.

**short circuit** = when electricity flows directly between a live and neutral conductor, for example wires, resulting in a dangerously high electric current.

Do task 14a

read the email and summarize the problem

Do task 14b

**Answers**

1. Isolate the electrical supply.
2. Dismantle the external panels.
3. Drain the lubricant.
4. Check for internal damage.
5. Remove damaged parts and replace them.
6. Add lubricant.
7. Adjust the blades.
8. Put on the external panels.
9. Reconnect the electrical supply.
10. Test the machine.

Do task 15
A useful link
http://www.youtube.com/watch?v=VcUGC_GoVnc