

**Entrance Examination in Finland
for Engineering Education
Universities of Applied Sciences
April 2016**

INSTRUCTIONS

The examination consists of two parts:

Part 1: Mathematics, logical deduction, Physics and Chemistry, learning prerequisites.

Part 2: English language.

The total duration of the exam is 3 hours. There is no break between the two parts. You may not leave the examination room within the first 90 minutes.

You may only bring your writing material (pencil, sharpener, rubber and ruler) to the examination. Calculators or any other electronic devices as well as formula books or dictionaries are not allowed. Answer sheets and extra paper are distributed with the exam papers. **All papers must be returned. Please use a pencil and not a pen.**

Part I (Mathematics, logical deduction, Physics and Chemistry, learning prerequisites)

There are 9 problems to be solved. **Of questions 7 and 8, choose either alternative A or B.** Problems 5 and 9 are worth 6 point each, other problems are worth 4 point each. Maximum score is 40 points. You need to score at least 10 points in order to be approved for selection.

Write your solutions in the provided space on the answer sheet and write the final answer in the specified place. **Only solutions written on your answer sheets will be checked! Include details of calculation whenever the solution requires calculations.**

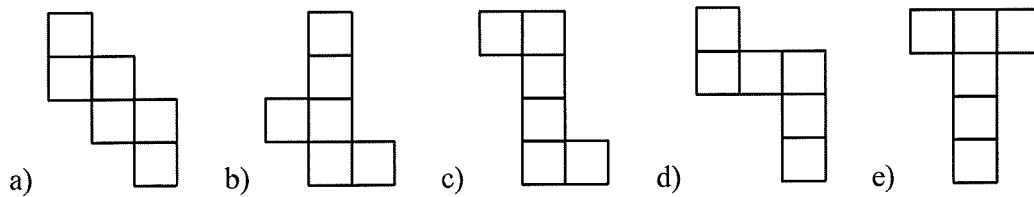
Part II (English)

Each multiple choice question is worth 0.5 points and questions 5 and 6 are worth 3 points each. The maximum score is 8 points. You need to score at least 4 points in order to be approved for selection.

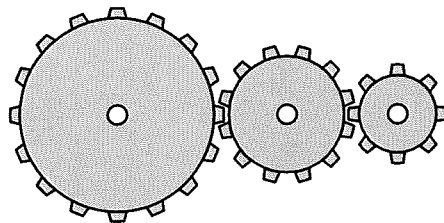
Part I (Mathematics, logical deduction, Physics and Chemistry, learning prerequisites)

Problems 1 – 6: Answer to all questions.

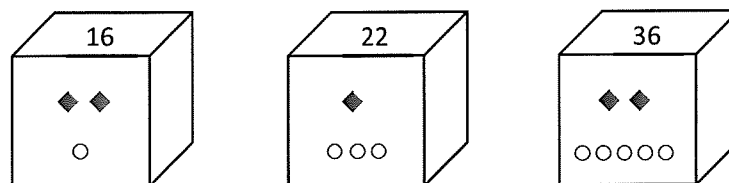
1. A cube can be unfolded in several ways. Below you can see some attempts. One of the following constructs is impossible. Which one?



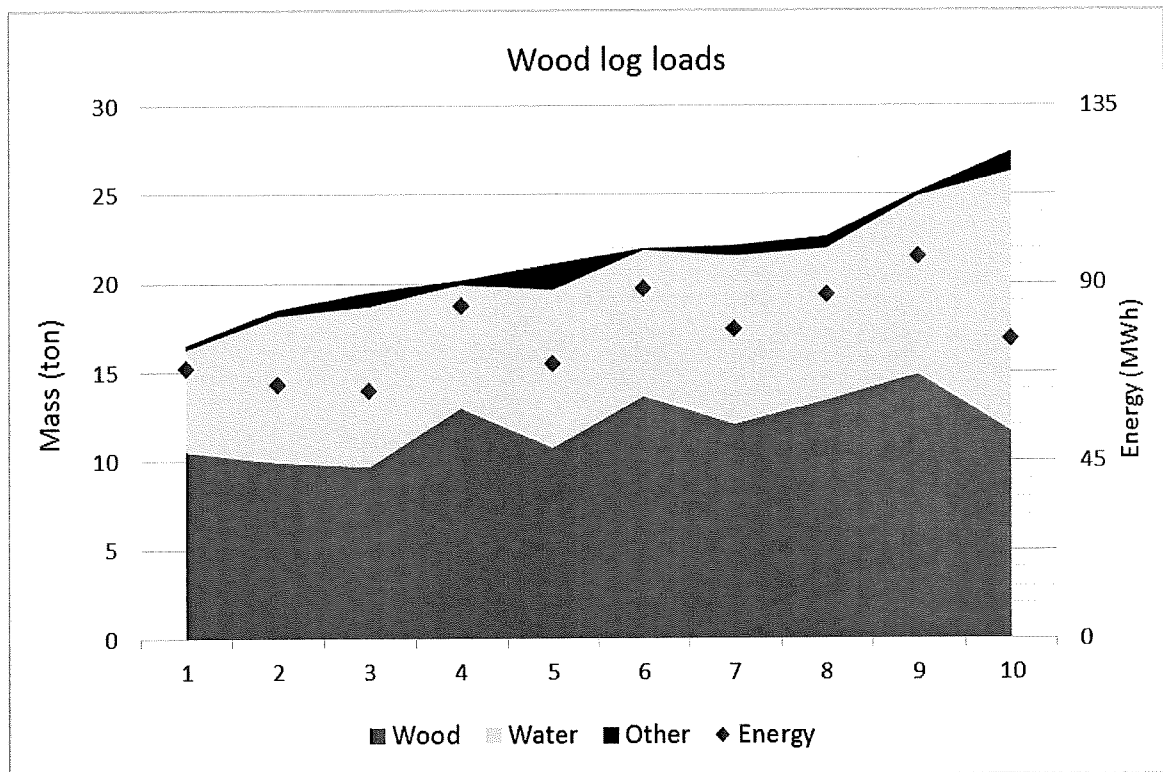
2. The smallest wheel turns clockwise at a speed of 300 rounds per minute. How many times will the largest wheel turn in one hour?



3. The weight of a box is measured three times with different contents. Determine the weight of the box when it is empty.



4. Wood logs from forest are transported to a power plant in trucks. In an investigation, ten truckloads were x-rayed and the contents analyzed. The diagram below shows how the total mass of each load was divided between wood, water and other redundant ingredients like soil, snow, ice, etc.
- Which truckload carried the least energy?
 - Calculate the moisture content in wood in the ninth load.

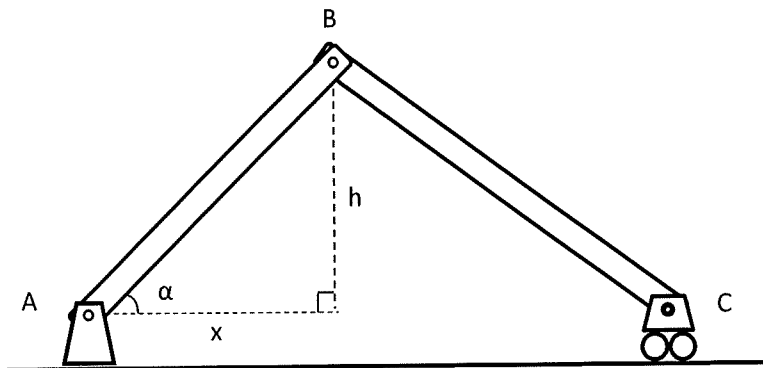


5. a) Solve x from $2^4 - (1 - 3x) = 3$.
- b) Solve y from $\frac{2}{5} = \frac{1}{2} \cdot \left(3 - \frac{y}{3}\right)$.
- c) Solve r from $4\pi r^2 h = \frac{V}{3}$.
- d) Solve a from $100\text{mm} \cdot 150\text{mm} \cdot 50\text{mm} + a \cdot 2000\text{mm}^2 = 1 \text{ L}$. L refers to liters.

6. The picture below shows a mechanism with two bars and three joints. Joint A is fixed to the base but joint C can move horizontally. The distance between points A and B is 1500 mm. The vertical separation of the same points is $h = 510$ mm.

a) Calculate the angle α and the horizontal separation x

b) If the joint C is moved in such way that the joint B moves 450mm upwards, how much does the joint B move in horizontal direction?



α	$\sin(\alpha)$	$\cos(\alpha)$	$\tan(\alpha)$
0°	0	1	0
10°	0,17	0,98	0,18
20°	0,34	0,94	0,36
30°	0,50	0,87	0,58
40°	0,64	0,77	0,84
50°	0,77	0,64	1,19
60°	0,87	0,50	1,73
70°	0,94	0,34	2,75
80°	0,98	0,17	5,67
90°	1	0	
100°	0,98	-0,17	-5,67
110°	0,94	-0,34	-2,75
120°	0,87	-0,50	-1,73
130°	0,77	-0,64	-1,19
140°	0,64	-0,77	-0,84
150°	0,50	-0,87	-0,58
160°	0,34	-0,94	-0,36
170°	0,17	-0,98	-0,18
180°	0	-1	0

Problems 7 and 8: Answer to either alternative A or B. If you provide two answers, the one with the lower score will be counted.

7. A. Physics

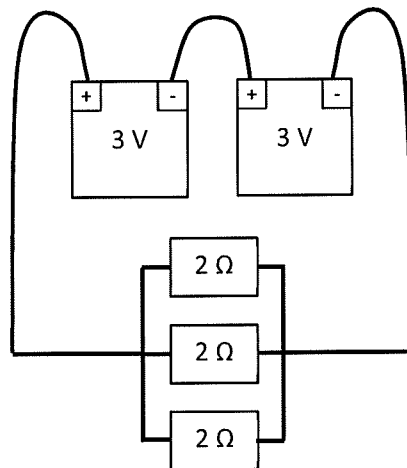
A car traveling 60 km/h drives off the edge of a 45 m high cliff and 3 seconds later hits the horizontal ground. How far is that from the vertical cliff? Use $g = 10 \text{ m/s}^2$.

B. Chemistry

Calculate the concentration of hydrochloric acid in a water solution whose pH is 4,0

8. A. Physics

Two batteries and three resistors are connected as shown in the diagram. Calculate the total power loss in the resistors.



B. Chemistry

Analysis shows a compound to contain 50% oxygen, 44% nitrogen and 6% hydrogen by mass. Which is a possible molecular formula for the substance?

- a) NH_4NO_2
- b) NH_4NO_3
- c) NH_3OH
- d) N_2OH

Show your work. Use atomic masses $m_{\text{H}} = 1$, $m_{\text{O}} = 16$, $m_{\text{N}} = 14$.

9. Describe the **strengths, weaknesses, opportunities and threats** regarding your studies and graduation. What are the things in your life that affect your possibilities to focus on your studies, positively and negatively? Please, answer using full sentences (200-250 words).

Part II (English)

Read the text Smart Logistics Solution for Waste Collection Launched at IFAT on the next page. Based on the text, answer the questions 1 – 6. First four questions are multiple-choice and you must choose only one alternative. Your answer to questions 5 and 6 should use full sentences containing 50 – 100 words per question.

1. Which of the statements is false?
 - a) Enevo ONE service can help predict how often waste containers need to be emptied
 - b) One of the collection parameters of Enevo ONE service is the cost efficient collection plan
 - c) Enevo ONE service can provide information on blocked roads or traffic jams
 - d) The cost-efficiency of Enevo ONE service comes from combining new technology with economic and ecological thinking

2. Driving efficient collection routes
 - a) has the downside of increasing bottlenecks in traffic
 - b) can cut down emissions but at the same time damage the collection fleet
 - c) is beneficial for both the natural environment and the neatness and coziness of the living environment
 - d) will benefit the environment by making people more aware of the amount of litter in their living environment

3. The end-customer can benefit from the service because
 - a) they will generate less waste
 - b) there will be more expensive, quality-services available for them
 - c) transparent services are likely to increase overcharging
 - d) it will be possible to follow and adapt their consumption habits

4. The customer using the Enevo ONE service will pay
 - a) monthly for a package that includes the technological equipment and service, and only for the monitored containers
 - b) monthly for a package that includes the sensor, data transfer and web service, plus a small fee per each monitored container
 - c) an initial fee before starting to use the service and a small monthly fee for each monitored container
 - d) only a small monthly subscription fee including the sensor, data transfer and a tablet computer or a mobile device

5. Think of as many different target groups for the Enevo ONE service as you can. Who could utilize the service and why?

6. Why does Enevo ONE utilize Twitter? What other ways to use the social media related to the environment/recycling could you think of that might be useful for (some of) the target groups you mentioned in question 5?

Smart Logistics Solution for Waste Collection Launched at IFAT

The Finland based, international technology company Enevo will launch its revolutionary Enevo ONE service for the European market this week at IFAT 2014. The service uses smart sensors and cloud computing to cut waste collection costs with up to 50%.

Generates the most cost efficient collection plans

Enevo ONE is a comprehensive logistics solution that saves time, money and environment. It uses wireless sensors to measure and forecast the fill level of waste and recycling containers. The service combines fill-level forecasts with an extensive set of collection parameters (e.g. traffic information, vehicle information, road restrictions) in order to calculate the most cost efficient collection plan. This smart plan is automatically generated and can be accessed by the driver through a tablet.

From static routes to dynamic routes

Until now waste collection has been done using static routes and schedules that require a lot of planning and deliver suboptimal results. By turning static collection schedules and routes into dynamic smart plans, which are based on real data from the field, waste management companies can avoid driving inefficient routes and save up to 50% in collection costs. These cost savings come from reduced vehicle wear, work hours and fuel consumption along with the better overall utilization of the collection fleet. Driving efficient collection routes also benefits the environment through decreased emissions, less congestion on the roads and prevention of overflowing containers and litter at collection sites.

Benefits also the environment and the end-customer

The service also creates more transparency and control to the collection chain: there is less room for foul play and overcharging. The waste producers (e.g. residents, offices and institutions) receive a higher quality of service and can track how much waste they generate.

No up-front investment required for savings

Introducing the service doesn't require any upfront investments. Enevo charges only a small monthly subscription fee per container that is being monitored. This monthly fee covers the entire system: the sensor, data transfer and access to the Enevo ONE web service that can be accessed using tablet computers and mobile devices for on the field operations. The customer can unlock the savings directly after installing the sensors.

Tweeting trashcans showcased at IFAT

To demonstrate the impact of smart city technology, Enevo is showcasing tweeting trashcans. Sensors around the world will feed their status in real-time to a Twitter account. You can follow the tweeting trashcans at @trashcanlife. "The internet of things is becoming a daily part of our life, and with this feature we are able to demonstrate in a simple way how even our trashcans can be connected to the internet. Internet connected sensors increase the awareness of our surrounding world and brings to light things that otherwise would remain hidden. This will have an impact on our environmental behavior and help us make smarter decisions" says Fredrik Kekäläinen, CEO of Enevo.

Enevo at IFAT 2014

<http://www.enevo.com/news/?n=smart-logistics-solution-waste-collection-launched-ifat>