

Master Admission Test Questions

Master Course „Energy & Transport Management“

General:

1. A hot cup of coffee, at about 70°C, cools down after having been left in a cold room. Please make a raw sketch of a typical cooling curve (temperature over time). Which type of mathematical function is this? What would a differential equation describing the time dependency of temperature roughly look like?
2. In many cases testing of real processes (e.g. car crash tests, aviation safety, traffic in a city network, etc.) is either too expensive, or too dangerous, or too complicated. Taking this into consideration, please explain, without going into detail, the importance of simulation models and how their mathematical structure is generally designed.
3. Which materials perform best in contact with wet corrosive flue-gases (e.g. from home heating) containing SO₂ or HCl, at low temperatures (below 100°C)?
4. Results of measurements always tend to be inaccurate. List and explain the different types of errors occurring in measurements.
5. What is the difference between steering (open loop control, *Steuerung*) and controlling (closed loop control, *Regelung*)? What are the advantages of controlling compared to steering?
6. What is the function of a “sensor” in a control loop?
7. If you pay your electricity bill at home, do you pay for power (*Leistung*) utilization or for the consumption of energy (*Arbeit*)? How do power and energy relate to each other? What are the main components of your electricity bill and which component(s) can be changed by yourself?

Business Management:

8. Analysing a company’s financial statement: Which are the key figures you look at to assess the company’s liquidity? Which are the most important ratios to analyse the situation?

9. Explain the different types of equity financing (*Eigenfinanzierung*) and debt financing (*Fremdfinanzierung*)?
10. What is a “break-even-point”? How do you calculate it?
11. A new product shows a negative contribution margin. What should be done? When answering the question, take into consideration the following aspects: direct costs, indirect costs, selling price and order acceptance.
12. Describe a typical tool for time-scheduling in project-management. Which milestones could be useful in a classical project?
13. You are planning to found a company together with two other colleagues. Which corporate or legal form would you consider? Explain the most important legal forms according to Austrian law, including their advantages and disadvantages.
14. Explain Porter’s Five Forces Model and its different dimensions. In which context is the model used?
15. Goals are a vital part of business, not only for HR management, but also in the strategic development of a company. Which principles are relevant for a well-defined goal? Please phrase a goal based on these principles.

Environment:

16. Please explain the formation of nitrous oxides during combustion processes. How can these pollutants be destroyed in the flue gas of fuel driven vehicles and of power plants to a great extent?
17. Which gases are most important for the greenhouse effect? What does the “Global Warming Potential” (GWP) of gases mean? Which gases have a high GWP and where are they emitted?
18. Please explain the environmental impact of individual motorized traffic and of railway traffic. Discuss trends of the near future and how developments in modal split may improve the situation.
19. Where do emissions of particulate matter in traffic come from? What kind of impact do they have on human health?

- 20.** Ozone is an oxidizing gas and is present in two layers of the atmosphere. Which type of ozone is useful and which one is harmful to person's health? What was the reason for the hole in the ozone layer? Which precursors are necessary for the formation of the "harmful" ozone and what are the impacts on human beings and the environment?
- 21.** What does the structure of a mechanical-biological wastewater treatment plant look like? Please describe the different steps. Why is chemical oxidation applied? What happens with the sludge?
- 22.** Which sector emits the highest amounts of ammonia? What are the reasons for it? Please explain two impacts through high emissions of ammonia on the environment.
- 23.** What are some characteristics of an environmental impact assessment (Umweltverträglichkeitsprüfung)? Which projects have to undergo an environmental impact assessment?
- 24.** What are the two main environmental management systems (EMS) and which principle is underlying both systems? Please make a sketch and describe this principle with reference to EMS.
- 25.** What does the hierarchy of waste management look like? Describe each level by using an example. Why is it necessary to separate waste?

Energy:

- 26.** Draw a sketch of a transformer and explain the different parts. What is transformed and what is in electrical power transport applications always nearly constant between the two sides?
- 27.** Please describe the basic principle of electric machines (e.g. motor). What is the difference between an asynchronous and a synchronous motor? List fields of applications for each type!
- 28.** Which energy form is used by conventional hydro power plants? Which energy forms are intermediate steps on the path during conversion to electricity at the end? Which parameters have an influence on the power output of the power station? Will these parameters have an influence for the selection of the type of turbines? (Detailed explanation of turbines is not necessary!)

- 29.** Why are there various electrical power transmission lines? What are the functions of each of them? Why aren't already more high-voltage underground cables installed, instead of the visible overhead pylon transmission lines?
- 30.** Why can thermal process cycles never reach efficiencies of 100%? Give two important reasons, quoting on the one hand the idealized "Carnot cycle" and on the other hand the non-ideality of a real situation.
- 31.** By which three effects/principles can heat be transferred? Please explain their importance in various environments.
- 32.** Which electricity systems do you know and which voltage steps are required for different consumers (e.g. industrial facilities, business enterprises) and producers of electric power (e.g. power plants, solar power systems)?
- 33.** What is the benefit of combined-heat-and-power (CHP) - plants compared to a separate generation of heat in boilers and power in condensing power plants? What type of heat demand can be covered with CHP-heat? Is there an effect of CHP-heat-extraction on the power output of the plant?
- 34.** To even out the electricity production and electricity demand storage systems are necessary. Which technologies/types are able to store electricity in general and which one is used to store a great amount of electricity? Which technology is mainly used to store surplus electricity out of photovoltaic systems? Explain the function of such a grid connected PV system including a storage system.
- 35.** Which technologies are available on the market to charge electric driven cars? What are their advantages and disadvantages? How long does it take to charge a car (22 kWh) with a quickcharger compared to a simple household charging station?

Mobility:

- 36.** What do you need for an international transport of goods by road (e.g. documents, vehicles, infrastructure)?
- 37.** What are the differences between road and railway transportation systems (spontaneity, safety, responsibility, capacity, control centres)? What does that mean for their use in door-to-door-delivery?

- 38.** Which different propulsion technologies (fuels) are used in the mobility sector? Discuss current problems they are facing and trends of the near future.
- 39.** What are the main aspects to be taken into account when goods are transported from Asia to Europe? Describe in this context different transportation modes as well as their advantages and disadvantages.
- 40.** How homogenous is the European railway infrastructure? If there are differences, explain them (e.g. infrastructure, electricity systems, communication systems, regulations, etc.).
- 41.** What are the levels of service for highways and why is it important for the highway operator to know which level the highway has?
- 42.** Which types of logistics do you know? Please describe each type briefly.
- 43.** Road infrastructure (e.g. highways, rural roads, etc.) is constructed, maintained, overhauled or even reconstructed through the earnings of road tolls. List and explain different types of road tolls within Europe (e.g. Austria, other European countries).
- 44.** Explain the advantages and disadvantages of autonomous driving. Think about car ownership, costs, working/leisure time, driving licence, public transport, legal regulations (e.g. who is responsible in case of an accident?)
- 45.** In the last decades the tendency was to have a single family house in the suburbs. What is this phenomenon called if it is happening almost uncontrolled? What are the effects concerning infrastructure (e.g. sewage systems, roads, public transport, public institutions, etc.)? Which developments in spatial planning are able to counteract this phenomenon and what are the consequences for the infrastructure as well as the mobility system?