
Economic Commission for Europe**Inland Transport Committee****5 January 2011****Working Party on the Transport of Dangerous Goods****Joint Meeting of Experts on the Regulations annexed to the European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN) (ADN Safety Committee)****Eighteenth session**

Geneva, 24–27 January 2011

Item 5 of the provisional agenda

Catalogue of questions

Instructions for the ADN experts' examination (ADN, Chapter 8.2)**Transmitted by the Central Commission for the Navigation of the Rhine (CCNR)****1. General**

To improve safety during the transport of dangerous goods, an expert capable of proving specialized knowledge of the transport of dangerous goods must be on board the vessel.

Basing itself on Chapter 8.2 of the Regulations annexed to the European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN), the Safety Committee covered by article 18 of ADN has established the following instructions, according to which examinations must be held in all the Contracting Parties of ADN.

The examinations covered by subsection 8.2.2.7 shall be organized by examination committees, which shall comprise:

- A Chairperson; and
- At least two assessors with the required proficiency.

Candidates who pass the examination shall be issued an ADN specialized knowledge certificate as stipulated by subsection 8.2.2.8 [8.2.1.2], in conjunction with subsection 8.2.1.5 or 8.2.1.7.

[In the event of doubts or obvious misunderstandings, the examination committee may establish, by means of a technical discussion with the candidate, whether or not the examination may be considered as passed. Justification must be given.]

Candidates who fail the examination shall be informed [in writing] of the reasons why they failed.

The examination committee may set requirements or conditions for retaking the examination or may grant an exemption from retaking certain parts of the examination. This exemption shall be valid for a maximum of two years. The examination may be retaken only after a waiting period of at least two months.

2. Numbering of examination questions in the catalogue

The numbering of the questions in the catalogue is independent of language, continuous and straightforward.

In order to accommodate computer procedures, the numbering consists of a series of eight digits.

The first indicates whether the question relates to basic or specialized training ("gases" or "chemistry").

The second indicates whether the question is part of the general training section or of the "dry cargo" or "tank navigation" parts.

The third indicates whether the question is based on "basic knowledge", "knowledge of physics and chemistry", "practical knowledge" or "emergency measures".

The fourth, fifth and sixth indicate the examination objective. To make the numbering easier to understand, this code is taken from the current examination objectives (for example, 01.1 or 10.0).

The seventh and eighth digits indicate the number of the question. They are separated from the "objective" part by a hyphen.

Row	Possible number codes	Subject
1	1	Basic training
	2	Specialization in gases
	3	Specialization in chemistry
2	1	General
	2	Dry cargo vessels
	3	Tank vessels
3	0	Basic knowledge
	1	Knowledge of physics and chemistry
	2	Practical knowledge
	3	Emergency measures
	4 to 6	Examination objective under 8.2.2.3.1
	7 and 8	Continuous numbering – maximum 99 questions possible

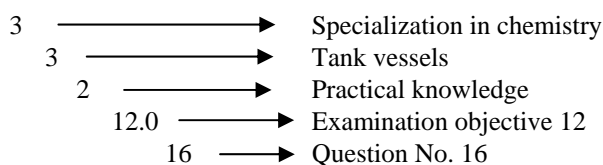
A "0" is sometimes used to fill empty spaces.

Examples:

110 06.0-01 Basic training – general – basic knowledge – examination objective 6 – question No. 1.

231 01.1-11 Specialization in gases – tank-vessel navigation – knowledge of physics and chemistry – examination objective 1.1 – question No. 11.

332 12.0-16 Specialization in chemistry – tank-vessel navigation – practical knowledge – examination objective 12 – question No. 16.



3. Examinations

3.1 Basic training course

Examinations for basic training shall be held in accordance with 8.2.2.7.1.

For the basic training examination, the candidate may choose from three types of examinations:

- Examination on general ADN questions and on ADN dry cargo vessels;
- Examination on general ADN questions and on ADN tank vessels; or
- Examination on general ADN questions and on ADN dry cargo and tank vessels.

The attached matrix (3.1.1) should be used when preparing the examination questions.

[Catalogue of questions for basic training courses]

The questions in the catalogue of questions for basic training courses are divided into three parts: "General", "Dry cargo vessels" and "Tank vessels". Each of these parts is divided into examination objectives.

Each examination objective is in turn divided up into examination questions, thus providing better coverage of the examination objective.

General:

- The candidate has an understanding of the objective and structure of ADN.
 - What is the objective of ADN?
 - Where is ADN applicable?
 - ADN is divided into how many parts, and what is the content (in general) of each part?
 - What parts must be on board during the transport of dangerous goods?
 - What is the relationship between the different parts?
 - When (to what quantities) is ADN applicable?
 - Explain the numbering system of parts 7 and 9.
 - Where are the transitional provisions in ADN, and what is their purpose?
 - How should the transitional provisions be applied?

Construction and equipment:

- The candidate has an understanding of the construction of ADN vessels.

- What ADN equipment is required?
- The ADN equipment is inspected by whom, and when?

Measurement techniques:

- The candidate has an understanding of how to measure toxicity, oxygen content and explosivity.
 - When are measuring instruments required on board ADN vessels?
 - What measuring instruments may be required on board?
 - What requirements are applied to the measuring (monitoring) instruments?
 - Where, and from what location, must the measurements be taken?
 - When and how must the measurements be recorded?
 - What is the meaning of “upper explosive limit” and “lower explosive limit” and “explosivity range” during transport on board ADN vessels?
 - In what cases should oxygen content be measured?
 - How can the readings of an oxygen meter be interpreted?
 - In what cases should the risk of explosion be measured?
 - How can the readings of an explosimeter be interpreted?

Knowledge of products:

- The candidate has an understanding of the risks and classification of dangerous goods.
 - What kind of risks may be posed by dangerous goods?
 - How are dangerous goods classified under ADN?
 - How can you find out about the risks of a given substance?
 - What are the risks posed by acids, bases and hydrocarbons?
 - What is the meaning of: flash point, boiling point, vapour pressure?
 - What chemical reactions may occur during the transport of dangerous goods?

Loading, unloading and transport:

- The candidate has an understanding of loading and unloading of vessels and the general requirements for operation and transport.
 - How can one determine, based on a vessel’s construction or equipment, whether a given substance may be transported?
 - Where is loading, unloading and transloading possible?
 - When is the authorization of the local competent authority required for loading, unloading and transloading?
 - When and how must announcements be made in accordance with the obligation to report or the reporting and monitoring system?
 - When must reports be made in accordance with the obligation to report or the reporting and monitoring system?

- For what goods is vessel marking required, and where can the requirement be found?
- In what conditions can a marking be removed?
- When is a “do not approach” signal required?
- When may persons who are not crew members travel on board?
- When and where is smoking permitted?

Documents:

- The candidate has an understanding of the documents accompanying the transport.
 - What is the objective of the instructions in writing? When must they be on board? Who draws them up and where must they be kept?
 - What are the duties and responsibilities of the master in respect of the instructions in writing?
 - What information must be included in a transport document?

Hazards and measures of prevention:

- The candidate has an understanding of prevention and general safety measures.
 - How can the hazards of dangerous goods be foreseen?
 - How can the hazards of acids, bases and hydrocarbons be foreseen?
 - What noxious physical effects can result from a person coming into contact with a corrosive substance?
 - What is to be done in the event of contact with a corrosive substance?
 - When is it possible to enter a closed space?
 - How can it be determined that it is possible to enter a closed space?
 - What is to be done in the event of a leak of a dangerous substance?
 - What noxious physical effects can result from a person inhaling a dangerous gas?
 - What is to be done in the event of inhalation of a dangerous gas?
 - In what conditions can liquids with a flash point under 55° C be used?
- The candidate has an understanding of the formation of sparks.
 - What devices are authorized for use in and outside of, respectively, the protected area and the cargo area, and when?
 - What work is authorized in and outside of, respectively, the protected area and the cargo area, and when?
- The candidate has an understanding of personal protective equipment.
 - What personal protection must be worn when measuring for toxicity, oxygen content and explosivity?
 - What personal protection may be required to enter a closed space?
- The candidate has an understanding of fire and fire-fighting techniques.
 - Explain the principles of the fire triangle.

- What are the different kinds of fire? (solid, liquid, gas or electrical fires)
- What are the main causes of fires? (for example, open flame, mechanical causes, electrical causes, chemical reactions, heat transmission)
- What are the different kinds of fires, and when is this classification used?
- What are the different kinds of fire extinguishers? (liquid, dry, gas)
- What are the extinguishing agents (water, vapour, foam, AFFF, sand, powder, blankets, CO₂)? How do extinguishing agents work? What are the possible advantages and drawbacks of the various extinguishing agents?
- What are the kinds of small extinguishers? (powder, dry ice, foam, dry standpipe, integrated systems) and how do they work (in general)?
- What are the most prevalently used extinguishing methods? (removal of the fuel source, blocking the oxygen supply, lowering the temperature)

Practical exercises:

- Practical exercises, including entry into spaces, the use of extinguishers and fire extinguishing facilities, use of personal protective equipment, gas detectors, oxygen metres and toximeters.

Dry cargo vessels**Construction and equipment:**

- The candidate has an understanding of the construction of dry cargo vessels.
 - What are the differences between a double-hull and a single-hull vessel?
 - What information is given by a stability calculation in the event of a leak?

Treatment of holds and adjacent spaces:

- The candidate has an understanding of degassing, cleaning and maintenance.
 - When is it necessary to degas a hold?
 - When is it necessary to clean a hold?
- The candidate has an understanding of the ventilation of holds and spaces outside the protected area.
 - When is ventilation of holds required?
 - How often is ventilation required?

Loading, unloading and transport:

- The candidate has an understanding of loading and unloading and of the general service requirements and transport requirements.
 - When and how can containers be loaded under ADN?
 - What are the requirements for mixed loading of containers?
 - What are the restrictions applicable to transported quantities?
 - When (and as from what quantities) is ADN applicable?

- When should loading or unloading be interrupted?
- The candidate has an understanding of the labelling of packages.
 - What colours and symbols can danger labels have, and what do they mean?

Documents:

- The candidate has an understanding of the documents accompanying the transport.
 - What documents are required for the transport of dangerous goods? Who issues them, when are they issued and what is their period of validity?
 - Explain the aim and function of the required documents.
 - Under ADN, what purpose is served and what needs are met by the stowage plan?
 - Under ADN, what must be included in the stowage plan?

Hazards and measures of prevention:

- The candidate has an understanding of prevention and general safety measures.
 - What is to be done if there is a leak of the product?
- The candidate has an understanding of personal protective equipment.
 - What personal protective equipment is required by ADN to deal with emergencies on board dry cargo vessels?
 - What personal equipment mentioned by ADN must be used in what emergencies?

Tank vessels

Construction and equipment:

- The candidate has an understanding of the construction of tank vessels.
 - Types C, G and N tank vessels are suitable for what kind of transport?
 - What is the difference between open tank vessels and closed tank vessels?
 - For type N vessels, what is the difference between single-hull and double-hull construction?
- The candidate has an understanding of ventilation and air extraction systems.
 - What kinds of ventilation and air extraction systems are mentioned in ADN?
 - What are the characteristics of the various kinds of ventilation and air extraction systems?
- The candidate has an understanding of the ADN loading and unloading system.
 - Under ADN, what requirements must be met by the loading and unloading system?

Treatment of holds and adjacent spaces:

- The candidate has an understanding of degassing, cleaning and maintenance.
 - In what conditions can cargo tank hatches be opened?

- In what conditions can flame-arresters be removed?
 - When must a cargo tank be degassed?
 - How can a cargo tank be degassed while ensuring that the safety measures are taken into consideration?
 - What does a certificate attesting gas-free condition attest to?
 - What must be done, taking into consideration the safety measures, to be able to clean the cargo tanks?
 - What are the inherent dangers in cleaning cargo tanks?
 - How can the dangers inherent to the cleaning of cargo tanks be avoided?
 - Describe existing cleaning techniques.
 - What are the requirements that must be met by an additional stripping system?
 - Who has to inspect the stripping system, and when?
- The candidate has an understanding of cargo heating.
 - What is the purpose of heating instructions?
 - Where in ADN can information be found on the boiling point and on cargo heating?
 - What are the errors that may be committed during cargo heating?
 - The candidate has an understanding of the handling of residual cargo tanks.
 - How should a residual cargo tank be equipped?
 - What can a residual cargo tank be used for?
 - What safety measures are taken before a residual cargo tank can be used?

Measurement and sampling technique:

- The candidate has an understanding of how to measure toxicity, oxygen content and explosivity.
 - Limits of the term “measurement technique”, basic course on navigation with tanks.
- The candidate has an understanding of how to take samples.
 - What types of sampling devices exist under ADN?
 - Under ADN, why is it necessary to use a given type of sampling device?
 - Explain the way in which the various types of sampling devices operate.
 - What safety measures must be taken when samples are taken?
 - In what conditions is it possible to open a sampling opening?

Loading, unloading and transport:

- The candidate has an understanding of loading and unloading and of the general service requirements and transport requirements.

- What is the influence of the following on loading and unloading: critical temperature, critical pressure, boiling point, solidification point, absolute zero, density?
 - How are Celsius degrees converted to kelvin and vice versa?
 - Describe, precisely in order, the actions required to prepare a vessel for loading.
 - Describe how the weight and distribution of the cargo can influence the stability of a vessel.
 - Explain the purposes during loading and unloading of vapour pipes, pipes for loading and unloading and discharging pumps.
 - What are the purposes and operating principles of pressure-relief valves, vacuum-relief valves, overfilling valves, level alarms, level indicating devices and flame-arresters?
 - What is the operating principle of a pressure pump and of a centrifugal pump, and what is the difference between these two systems?
 - When can a cavitation form, and what action should be taken if it does?
 - How is the interaction between temperature and degree of filling calculated?
 - What is the relationship between the weight of the cargo and the degree of filling?
 - How can it be determined whether a dangerous reaction has taken place between a substance and water?
 - What restrictions apply to quantities transported?
 - What measures must be taken outside the cargo area during loading and unloading?
 - In what conditions can the gaseous phase be rendered inert in cargo tanks?
- Documents:
 - The candidate has an understanding of the documents accompanying the transport.
 - What documents are required for the transport of dangerous goods? Who issues them, when are they issued and how long are they valid?
 - Explain the purpose and function of the required documents.
 - Explain the purpose and function of the lists of substances drawn up by the classification society.
 - What is the purpose of the checklist? When must it be drawn up? Where can it be found, and who must fill it in?
 - What is the purpose of the loading journal? When must it be drawn up? Who issues it and who must fill it in?

Hazards and measures of prevention:

- The candidate has an understanding of prevention and general safety measures.
 - What is to be done if there is a leak of the product?
 - When can static electricity be produced?

- How can static electricity be discharged?
- The candidate has an understanding of the formation of sparks.
 - What installations are authorized in and outside the cargo area and when can they be used?
 - What works can be done in and outside a hold, and in what conditions?
- The candidate has an understanding of personal protective equipment and safety equipment.
 - What personal protective equipment is required under ADN?
 - What personal protective equipment required under ADN must be worn during which kinds of works?
 - What personal protective equipment mentioned in ADN must be used in an emergency?
- The candidate has an understanding of fires and fire-fighting techniques.
 - What is the meaning of the following terms in the context of the transport of dangerous goods on tank vessels: detonation, deflagration, explosion, temperature, combustion and ignition?

3.1.1 Matrices for the examinations

Dry cargo transport

Objective		Number of questions in the catalogue		General	Dry cargo vessels	Total
		General	Dry cargo	Number of questions to choose	Number of questions to choose	Number of questions to choose
1	General	14	--	1	-	1
2	Construction and equipment	21	32	2	3	5
3	Treatment of holds and adjacent spaces	--	19	-	2	2
4	Measurement techniques	21	--	2	-	2
5	Knowledge of products	78	--	2	-	2
6	Loading, unloading and transport	19	70	2	5	7
7	Documents	31	22	3	2	5
8	Hazards and measures of protection	72	27	3	3	6
Total				15	15	30

Tank vessel transport

<i>Objective</i>		<i>Number of questions in the catalogue</i>		<i>General</i>	<i>Tank vessels</i>	<i>Total</i>
		<i>General</i>	<i>Tank vessels</i>	<i>Number of questions to choose</i>	<i>Number of questions to choose</i>	<i>Number of questions to choose</i>
1	General	14	--	1	-	1
2	Construction and equipment	21	50	2	2	4
3	Treatment of holds and adjacent spaces	--	33	-	3	3
4	Measurement techniques	21	13	2	1	3
5	Knowledge of products	78	--	2	-	2
6	Loading, unloading and transport	19	56	2	4	6
7	Documents	31	24	3	2	5
8	Hazards and measures of prevention	72	37	3	3	6
Total				15	15	30

Combined dry cargo and tank vessels

<i>Objective</i>		<i>Number of questions in the catalogue</i>			<i>General</i>	<i>Tank vessels</i>	<i>Dry cargo</i>	<i>Total</i>
		<i>General</i>	<i>Tank vessels</i>	<i>Dry cargo</i>	<i>Number of questions to choose</i>	<i>Number of questions to choose</i>	<i>Number of questions to choose</i>	<i>Number of questions to choose</i>
1	General	14	--	--	1	-	-	1
2	Construction and equipment	21	50	32	2	1	1	4
3	Treatment of holds and adjacent spaces	--	33	19	-	2	1	3
4	Measurement techniques	21	13	--	2	1	-	3
5	Knowledge of products	78	--	--	2	-	-	2
6	Loading, unloading and transport	19	56	70	2	1	3	6
7	Documents	31	24	22	3	1	1	5
8	Hazards and measures of prevention	72	37	27	3	2	1	6
Total					15	8	7	30

Catalogue of questions for basic training courses

The catalogue of questions for basic training courses is contained in documents ECE/TRANS/WP.15/AC.2/2009/12 to 17 (subject to numbering and editorial changes to be communicated separately).

3.2 Specialization course on gases

Candidates who are successful in the ADN basic training examination may apply for enrolment in a specialization course on gases.

The gas specialization examination shall be held in accordance with the provisions of ADN section 8.2.2.7.2.5.

The matrix in this catalogue of questions (3.2.1) shall be used when preparing the examination questions.

The examination shall be written and shall comprise two parts. The examination committee may choose the order of the two parts.

One of the parts of the examination shall comprise 30 questions chosen from the catalogue of multiple-choice questions on gases. The questionnaire shall be drawn up in accordance with the matrix found in section 3.2.1, below. This part of the examination takes 60 minutes. Each correct answer is worth one point. The maximum number of points is 30.

The other part of the examination (3.2.2) shall comprise 15 questions on a specific substance to be chosen by the examination committee from the catalogue of substantive questions on gases.

3.2.1 Matrix for the examination

Knowledge of physics and chemistry

<i>Examination objective</i>		<i>Number of questions in the catalogue</i>	<i>Number of questions on the examination</i>
1	Law of ideal gases		
1.1	Boyle; Gay-Lussac	10	1
1.2	Fundamental law	10	
2	Partial pressures and gas mixtures		
2.1	Definitions and simple calculations	10	1
2.2	Pressure increase and gas release from cargo tanks	10	
3	Avogadro's number and calculation of masses of ideal gases		
3.1	Molecular mass, mass and pressure at 15°C	10	1
3.2	Application of the mass formula	10	
4	Density and volume of liquids		
4.1	Density and volume in terms of temperature increase	10	1
4.2	Maximum degree of filling	10	
5	Critical pressure and temperature	5	
6	Polymerization		1
6.1	Theoretical questions	5	
6.2	Practical questions, conditions of carriage	10	1
7	Vaporization and condensation		
7.1	Definitions, etc.	10	1
7.2	Vapour pressure at saturation	10	
8	Mixtures as opposed to pure substances		
8.1	Vapour pressure and composition of mixtures	10	1
8.2	Chemical composition and hazard characteristics	10	
9	Chemical bonds and formulae	10	1
	Total		9

Practice

<i>Examination objective</i>		<i>Number of questions in the catalogue</i>	<i>Number of questions on the examination</i>
1	Flushing		
1.1	Flushing in the event of a change of cargo	5	1
1.2	Addition of air to the cargo	5	
1.3	Methods of flushing and degassing before entering cargo tanks	10	
2	Sampling	10	1
3	Danger of explosion	10	2
4	Health risks	10	1
5	Gas concentration measures		
5.1	Which devices to use	10	2
5.2	How to use them	10	2
6	Monitoring of closed spaces and entry to these spaces	10	1
7	Certificates for degassing and permitted work	10	1
8	Degree of filling and over-filling	10	1
9	Safety installations	10	2
10	Pumps and compressors	10	1
Total			17

Emergency measures

<i>Examination objective</i>		<i>Number of questions in the catalogue</i>	<i>Number of questions on the examination</i>
1	Physical injury		
1.1	Liquefied gasses on the skin	5	2*
1.2	Breathing in gas	5	
1.3	General assistance	5	
2	Irregularities relating to the cargo		
2.1	Leak in a connection	3	2*
2.2	Fire in the engine room	3	
2.3	Hazards in the vicinity of the vessel	4	
2.4	Over-filling	2	
2.5	Polymerization	3	
Total			4

* The questions must be taken from two different sub-parts.

3.2.2 Catalogue of substantive questions on gases

In addition to the situation description found in 3.2.2.1, the following documents shall also be made available to the candidate:

The chosen questions (3.2.2.2) (15 partial questions);

[Note: The substantive questions are listed in document ECE/TRANS/WP.15/AC.2/2011/4.]

Certificate of approval No. 001 as per 3.2.2.4;

The information sheet on the GASEX motor tanker equipment;

The sheet referred to in 3.2.2.3 containing information on the characteristics of the substance, including those related to a required breathing apparatus; and

The Safety Data Sheet with the maximum permissible concentration at the work place or equivalent documents for the chosen substance.

The texts of regulations and technical literature referred to in 8.2.2.7 of ADN are also authorized for use during the examination.

The questions regarding the threshold limit value at the workplace may not be used if no such maximum exists for the chosen substance.

3.2.2.1 Situation description

This section of the examination is based on the following situation descriptions:

II. Situation description

(See ECE/TRANS/WP.15/AC.2/2011/3, para. 3.2.2)

Situation description 01:

Loading and unloading

Your GASEX motor tanker has a 001 certificate of approval. The tank vessel has just left the shipyard; the cargo tanks were opened and the piping pressurized; the blocking valves are closed.

At terminal 1 the vessel is to be loaded with a maximum of UN XXXX (NAME, class, classification code, packing group), and it is later to be unloaded at terminal 2.

Loading port = terminal 1

The substance to be loaded is stored in spherical tanks.

The terminal can deliver a nitrogen flow of up to 1,000 m³/h at a maximum pressure of 5 bar (gauge) and has a flare stack with a capacity of 1,000 m³/h.

During loading the vapours/gas must not be returned to the on-shore spherical tank.

The terminal's loading flow is 250 m³/h.

The temperature of the substance and the ambient temperature are both 10° C.

Unloading port = terminal 2

The vessel is unloaded with the on-board pumps. The greatest possible quantity must be unloaded.

The substance is unloaded into a spherical storage tank. A gas return line is available.

The ambient temperature is 10° C.

Situation description 02:**Loading and unloading**

Your GASEX motor tanker has a 001 certificate of approval. The tank vessel is carrying UN 1011 BUTANE; the pressure in the cargo tank is 0.2 bar (gauge).

At terminal 1 the vessel has to load a maximum of UN XXXX (NAME, class, classification code, packing group), and it has to be unloaded at terminal 2.

Loading port = terminal 1

The substance to be loaded is stored in spherical tanks.

The terminal can deliver a nitrogen flow of up to 1,000 m³/h at a maximum pressure of 5 bar (gauge) and has a flare stack with a capacity of 1,000 m³/h.

During loading the vapours/gas must not be returned to the on-shore spherical tank.

The terminal's loading flow is 250 m³/h.

The temperature of the substance and the ambient temperature are both 10° C.

Unloading port = terminal 2

The vessel is unloaded with the on-board pumps. The greatest possible quantity must be unloaded.

The substance is unloaded into a spherical storage tank. A gas return line is available.

The ambient temperature is 10° C.

3.2.2.2 Questions

The questions must be selected in accordance with the following scheme. A logical order should be followed.

A: Preparation for loading

General questions:

Choose two questions from A-1, A-2 (a or b) and A-3.

[Note: for situation 01, question A-2a, for situation 02, question A-2b.]

Questions specific to the substance:

Choose one question from A-4/1 to A-4/6.

B: Flushing of cargo tanks

Choose three questions from B-1 to B-10.

C: Loading

General question:

Choose question C-1.

Choose three questions from C-2 to C-10.

[Note: C-3 and C-4 cannot both be chosen for the same examination session, nor can C-7 and C-8. Thus, C-3 or C-4 may be chosen, and C-7 or C-8 may be chosen. Question C-8 is not suitable for the following substances: 1-3-BUTADIENE, STABILIZED and VINYL CHLORIDE, STABILIZED.]

D: Load calculation

Choose three calculations D-1 to D-3.

E: Unloading

Choose two questions E-1 and E-2.

3.2.2.3 Substances and their characteristics

A substance and its accompanying information sheet should be chosen from among those in the following list.

Substance properties PROPANE

Name: PROPANE	UN number: 1978
Formula: C ₃ H ₈	Molar mass: $M = 44$ (44.096)
Boiling point: -42° C	
Ratio between the vapour density and that of air = 1 (15° C): 1.53	
Flammable mixture, vol.%: 2.0 - 9.5	
Auto-ignition temperature: +460° C	Critical temperature: +96.8° C
Maximum permissible concentration at the workplace: --- ppm	

<i>Vapour-liquid equilibrium</i>			
T [°C]	p_{\max} [bar]	ρ_L [kg/m ³]	ρ_G [kg/m ³]
- 10	3.45	541.9	7.54
- 5	4.06	535.4	8.81
0	4.74	528.7	10.23
5	5.50	521.8	11.82
10	6.36	514.7	13.63
15	7.31	507.5	15.65
20	8.36	500.0	17.90
25	9.51	492.3	20.39
30	10.78	484.3	23.18
35	12.17	476.1	
40	13.69	467.4	
45	15.35	458.4	
50	17.14	448.9	

Substance properties PROPYLENE

Name: PROPYLENE	UN number: 1077
Formula: C ₃ H ₆	Molar mass: $M = 42$ (42.080)
Boiling point: -48° C	
Ratio between the vapour density and that of air = 1 (15° C): 1.46	
Flammable mixture, vol.%: 2.0 - 11.1	
Auto-ignition temperature: +455° C	Critical temperature: +91.9° C
Maximum permissible concentration at the workplace: --- ppm	

<i>Vapour-liquid equilibrium</i>			
$T [^{\circ}\text{C}]$	$p_{max} [\text{bar}]$	$\rho_L [\text{kg/m}^3]$	$\rho_G [\text{kg/m}^3]$
- 10	4.28	559.9	9.05
- 5	5.01	552.9	10.54
0	5.83	545.7	12.22
5	6.75	538.3	14.11
10	7.78	530.7	16.25
15	8.91	522.8	18.62
20	10.16	514.7	21.28
25	11.53	506.4	24.23
30	13.04	497.7	27.53
35	14.69	488.6	
40	16.49	479.1	
45	18.44	469.2	
50	20.56	458.6	

Substance properties BUTANE

Name: BUTANE	UN number: 1011
Formula: C ₄ H ₁₀	Molar mass: $M = 58$ (58.123)
Boiling point: -0.5° C	
Ratio between the vapour density and that of air = 1 (15° C): 2.01	
Flammable mixture, vol.%: 1.1 - 8.5	
Auto-ignition temperature: +365° C	Critical temperature: +152° C
Maximum permissible concentration at the workplace: 600 ppm	

<i>Vapour-liquid equilibrium</i>			
T [°C]	p_{\max} [bar]	ρ_L [kg/m ³]	ρ_G [kg/m ³]
- 10	0.70	611.9	1.90
- 5	0.85	606.5	2.27
0	1.03	601.1	2.72
5	1.24	595.6	3.23
10	1.48	590.1	3.81
15	1.76	584.4	4.49
20	2.07	578.7	5.23
25	2.43	572.9	6.09
30	2.83	566.9	7.04
35	3.27	560.9	
40	3.77	554.7	
45	4.32	548.5	
50	4.93	542.0	

Substance properties ISOBUTANE

Name: ISOBUTANE	UN number: 1969
Formula: C ₄ H ₁₀	
Boiling Point: -12 °C	Molar mass: $M = 58$ (58.123)
Ratio between the vapour density and that of air = 1 (15°C): 2.01	
Flammable mixture, vol.%: 1.1–8.5	
Auto-ignition temperature: +460 °C	Critical temperature: ~ +152 °C
Maximum permissible concentration at the workplace: 600 ppm	

<i>Vapour-liquid equilibrium</i>			
T [°C]	p_{max} [bar]	ρ_L [kg/m ³]	ρ_G [kg/m ³]
- 10	1.08	592.0	2.96
- 5	1.31	586.3	3.55
0	1.56	580.6	4.18
5	1.86	574.8	4.94
10	2.20	568.9	5.79
15	2.58	562.9	6.73
20	3.00	556.8	7.77
25	3.48	550.5	8.96
30	4.01	544.2	10.28
35	4.60	537.6	
40	5.25	531.0	
45	5.96	524.1	
50	6.74	517.1	

Substance properties BUTYLENE-1

Name: BUTYLENE-1	UN number: 1012
Formula: C ₄ H ₈	
Boiling point: -6 °C	Molar mass: $M = 56$ (56.107)
Ratio between the vapour density and that of air = 1 (15°C): 1.94	
Flammable mixture, vol.%: 1.6–9.3	
Auto-ignition temperature: +384 °C	Critical temperature: +146.4 °C
Maximum permissible concentration at the workplace: --- ppm	

<i>Vapour-liquid equilibrium</i>			
T [°C]	p_{\max} [bar]	ρ_L [kg/m ³]	ρ_G [kg/m ³]
- 10	0.87	626.9	2.29
- 5	1.06	621.2	2.75
0	1.28	615.5	3.28
5	1.54	609.7	3.90
10	1.83	603.9	4.59
15	2.16	597.9	5.36
20	2.54	591.8	6.26
25	2.96	585.7	7.24
30	3.44	579.4	8.37
35	3.97	573.0	
40	4.56	566.4	
45	5.21	559.8	
50	5.93	552.9	

Substance properties ISOBUTYLENE

Name: ISOBUTYLENE	UN number: 1055
Formula: C ₄ H ₈	Molar mass: $M = 56$ (56.107)
Boiling point: -7 °C	
Ratio between the vapour density and that of air = 1 (15°C): 1.94	
Flammable mixture, vol.%: 1.8–9.0	
Auto-ignition temperature: +465 °C	Critical temperature: +144.7 °C
Maximum permissible concentration at the workplace: --- ppm	

<i>Vapour-liquid equilibrium</i>			
T [°C]	p_{max} [bar]	ρ_L [kg/m ³]	ρ_G [kg/m ³]
- 10	0.89	628.5	2.34
- 5	1.09	622.8	2.83
0	1.31	617.0	3.36
5	1.57	611.2	3.98
10	1.87	605.2	4.69
15	2.20	599.2	5.47
20	2.59	593.0	6.39
25	3.02	586.8	7.40
30	3.50	580.4	8.52
35	4.04	573.9	
40	4.65	567.3	
45	5.31	560.5	
50	6.05	553.6	

Substance properties BUTADIENE, STABILIZED, (1,3-butadiene)

Name: BUTADIENE, STABILIZED, (1,3-butadiene)	UN number: 1010
Formula: C ₄ H ₆	
Boiling point: -4 °C	Molar mass: $M = 54$ (54.092)
Ratio between the vapour density and that of air = 1 (15°C): 1.88	
Flammable mixture, vol.%: 1.6–16.5	
Auto-ignition temperature: +415 °C	Critical temperature: +152 °C
Maximum permissible concentration at the workplace: --- ppm	

<i>Vapour-liquid equilibrium</i>			
T [°C]	p_{max} [bar]	ρ_L [kg/m ³]	ρ_G [kg/m ³]
- 10	0.81	656.7	2.05
- 5	0.99	651.0	2.47
0	1.19	645.2	2.93
5	1.44	639.3	3.50
10	1.71	633.4	4.11
15	2.03	627.3	4.83
20	2.39	621.2	5.64
25	2.80	614.9	6.56
30	3.25	608.6	7.56
35	3.76	602.1	
40	4.33	595.5	
45	4.97	588.7	
50	5.67	581.9	

Substance properties AMMONIA, ANHYDROUS

Name: AMMONIA, ANHYDROUS	UN number: 1005
Formula: NH ₃	
Boiling point: -33 °C	Molar mass: $M = 17$ (17.032)
Ratio between the vapour density and that of air = 1 (15°C): 0.59	
Flammable mixture, vol.%: 15–29	
Auto-ignition temperature: +651 °C **	Critical temperature: +132.4 °C
Maximum permissible concentration at the workplace: --- ppm	

** From +450° C, decomposition begins, producing very flammable hydrogen (gas).

<i>Vapour-liquid equilibrium</i>			
T [°C]	p_{max} [bar]	ρ_L [kg/m ³]	ρ_G [kg/m ³]
- 35	0.93	684.6	
- 30	1.19	678.2	
- 25	1.51	671.8	
- 20	1.89	665.2	
- 15	2.35	658.6	
- 10	2.89	651.9	
- 5	3.52	645.0	
0	4.26	638.1	3.4
5	5.12	631.1	4.1
10	6.10	623.9	4.9
15	7.23	616.6	5.7
20	8.50	609.2	6.7
25	9.95	601.6	7.8
30	11.57	593.9	9.0
35	13.39	585.9	
40	15.42	577.9	
45	17.68	569.6	
50	20.17	561.1	

Substance properties VINYL CHLORIDE, STABILIZED

Name: VINYL CHLORIDE, STABILIZED	UN number: 1086
Formula: C ₂ H ₃ Cl	
Boiling point: -14 °C	Molar mass: $M = 62.50$
Ratio between the vapour density and that of air = 1 (15°C): 2.16	
Flammable mixture, vol.%: 4–26	
Auto-ignition temperature: +415 °C	Critical temperature: +158.4 °C
Maximum permissible concentration at the workplace: --- ppm*	

* Vinyl chloride, stabilized, is carcinogenic.

<i>Vapour-liquid equilibrium</i>			
$T [^{\circ}\text{C}]$	$p_{\text{max}} [\text{bar}]$	$\rho_{\text{L}} [\text{kg}/\text{m}^3]$	$\rho_{\text{G}} [\text{kg}/\text{m}^3]$
- 10	1.16	962.3	3.5
- 5	1.40	954.8	4
0	1.69	947.3	5
5	2.02	939.7	6
10	2.40	931.9	7
15	2.83	924.1	8
20	3.33	916.1	9
25	3.89	907.9	11
30	4.52	899.6	13

3.2.2.4 Certificate of approval; technical equipment

A certificate of approval should be selected, including the technical equipment.

IV. ADN certificate of approval No.: 001 (gas) and vessel technical equipment (see ECE/TRANS/WP.15/AC.2/2011/3, para. 3.2.2.4)

ADN certificate of approval No.: 001

- | | | |
|-----|--|---|
| 1. | Name of vessel: | GASEX |
| 2. | Official number: | 04090000 |
| 3. | Type of vessel: | motor tanker |
| 4. | Type of tank vessel: | G |
| 5. | Cargo tank designs | 1. Pressure cargo tanks ^{1,2}
2. Closed cargo tanks^{1,2}
3. Open cargo tanks with flame arresters^{1,2}
4. Open cargo tanks^{1,2} |
| 6. | Types of cargo tanks | 1. Independent cargo tanks ^{1,2}
2. Integral cargo tanks^{1,2}
3. Cargo tank wall distinct from the hull^{1,2} |
| 7. | Opening pressure of high velocity vent valves/safety valves ^{1,2} | 1.580 kPa |
| 8. | Additional equipment: | |
| | • Sampling device | |
| | connection for a sampling device | yes/ no ^{1,2} |
| | sampling opening | yes/ no ^{1,2} |
| | • Water-spray system | yes/ no ^{1,2} |
| | internal pressure alarm 40 kPa | yes/ no ^{1,2} |
| | • Cargo heating system: | |
| | possibility of cargo heating from shore | yes/ no ^{1,2} |
| | cargo heating installation on board | yes/ no ^{1,2} |
| | • Cargo refrigeration system | yes/ no ^{1,2} |
| | • Inerting facilities | yes/ no ^{1,2} |
| | • Cargo pump-room below deck | yes/ no ^{1,2} |
| | • Pressure device in the accommodation | |
| | at the stern of the vessel | yes/ no ^{1,2} |
| | • Gas supply/return line according to | ^{1,2} |
| | piping and installation heated | yes/ no ^{1,2} |
| | • Conforms to the rules of construction resulting from the remark(s) of column (20) of Table C of Chapter 3.2 ^{1,2} | |
| 9. | Electrical equipment: | |
| | • Temperature class: | T4 |
| | • Explosion group: | IIB |
| 10. | Loading rate: --- | |
| 11. | Permitted relative density: | 1.00 |
| 12. | Additional observations: ¹ | The connection for a sampling device can be used with an ETS. |

Technical equipment of the GASEX motor tanker

- A. Cargo tanks
 - Number: 6
 - Volume per cargo tank: 250 m³
 - Minimum authorized temperature: -10° C
- B. Pumps: 1 submerged pump per cargo tank
- C. Compressors: 2 compressors
- D. Piping systems: separate for liquids and gases (vapours)
- E. Possibility of longitudinal flushing: yes

The candidate shall have 90 minutes to complete this part of the examination. The maximum number of points is 30. The distribution of the points shall be set by the examination committee prior to the examination in accordance with the degree of difficulty of the questions.

The examination shall be marked in accordance with ADN section 8.2.2.7.2.5.

Multiple choice questions on gases

These questions can be found in documents ECE/TRANS/WP.15/AC.2/2009/23 and 34 to 38 (subject to numbering and editorial changes to be communicated separately).

Substantive questions on gases

(These questions can be found in document ECE/TRANS/WP.15/AC.2/2011/4, Part I. The answers can be found in documents ECE/TRANS/WP.15/AC.2/2011/5 and 6.)

3.3 Specialization course on chemicals

Candidates who are successful in the ADN basic training examination may apply for enrolment in a specialization course on chemicals, to be followed by an examination.

The chemicals specialization examination shall be held in accordance with the provisions of ADN section 8.2.2.7.2.5.

The matrix in this catalogue of questions (3.3.1) shall be used when preparing the examination questions.

The examination shall be written and shall comprise two parts. The examination committee may choose the order of the two parts.

One of the parts of the examination shall comprise 30 questions chosen from the catalogue of multiple-choice questions on chemicals. The questionnaire shall be drawn up in accordance with the matrix found in section 3.3.1, below. This part of the examination takes 60 minutes. Each correct answer is worth one point. The maximum number of points is 30.

The other part of the examination (3.3.2) shall comprise 15 questions on a specific substance, to be chosen by the examination committee from the catalogue of substantive questions on chemicals.

3.3.1 Matrix for the examination

Knowledge of physics and chemistry

<i>Examination objective</i>		<i>Number of questions in the catalogue</i>	<i>Number of questions on the examination</i>
	General	8	1
	Temperature, pressure, volume	23	1
	Physical state	11	1
	Fire, combustion	6	1
	Mass density (Density)	16	1
	Mixtures, chemical bonds	8	1
	Molecules, atoms	15	1
	Polymerization	17	1
	Acids, bases	16	1
	Oxidation	7	1
	Knowledge of products	20	1
	Chemical reactions	16	1
	Total		12

Practice

<i>Examination objective</i>		<i>Number of questions in the catalogue</i>	<i>Number of questions on the examination</i>
1	Measurement	14	2
2	Sampling techniques	12	1
3	Cleaning of cargo tanks, degassing, washing of tanks	24	3
4	Handling slops, residual cargo and residual substance tanks	10	2
5	Certificates for degassing and permitted work	12	2
6	Loading, unloading	34	3
7	Heating	12	2
Total			15

Emergency measures

<i>Examination objective</i>		<i>Number of questions in the catalogue</i>	<i>Number of questions on the examination</i>
1	Physical injury	7	0 or 1
2	Material damage	6	0 or 1
3	Environmental damage	5	0 or 1
4	Damage-control plans	6	0 or 1
Total			3

3.3.2 Catalogue of questions for the specialization course on chemicals

In addition to the situation description found in 3.3.2.1, the following documents shall also be made available to the candidate:

The chosen questions (3.3.2.2) (15 partial questions);

[Note: The list of questions can be found in document ECE/TRANS/WP.15/AC.2/2011/7, Part I.]

A certificate of approval as per 3.3.2.4;

Information on requirements for a breathing apparatus; as well as

The EC Safety Data Sheet with the threshold limit value at the workplace or equivalent documents for the chosen substance.

The texts of regulations and technical literature referred to in 8.2.2.7 of ADN are also authorized for use during the examination.

The questions regarding the threshold limit value at the workplace may not be used if no such limit exists for the chosen substance.

3.3.2.1 Situation description

This section of the examination is based on the following situation descriptions:

Your motor tanker (NAME OF VESSEL) carries certificate of approval No. (xx).

You receive an order to transport 1 500 tonnes of UN No. XXXX (name, class, classification code, packing group).

Your tank vessel is empty. The previous cargo was UN No. XXXX (name, class, classification code, packing group).

The outside temperature during loading is +9° C.

3.3.2.2 Questions

The questions must be selected in accordance with the following scheme. A logical order should be followed.

A Loading (including preparation)

General questions:

Choose three questions from A-1 to A-11.

Questions specific to the substance:

Choose one question from E-1 to E-20.

B Transport

General questions:

Choose three questions from B-1 to B-10.

Questions specific to the substance:

Choose one question from E-1 to E-20.

C Unloading (including preparation)

General questions:

Choose three questions from C-1 to C-10.

D Flushing

General questions:

Choose three questions from D-1 to D-13.

Questions specific to the substance:

Choose one question from among E-1 to E-20.

3.3.2.3 Properties of substances

A substance should be chosen from the following list and included in the situation description in 3.3.2.1 along with its properties.

The substances listed in the table may be included in the certificates of approval referred to in 3.3.2.4, below.

<i>UN No.</i>	<i>Name and description</i>	<i>Class</i>	<i>Classification code</i>	<i>Packing group</i>	<i>Certificate of approval No.</i>
Flammable					
1089	ACETALDEHYDE	3	F1	I	03
1125	n-BUTYLAMINE	3	FC	II	01, 03
1155	DIETHYL ETHER	3	F1	I	03
1275	PROPIONALDEHYDE	3	F1	II	01
1991	CHLOROPRENE, STABILIZED	3	FT1	I	01, 03
Toxic					
1163	DIMETHYLHYDRAZINE, UNSYMMETRICAL	6.1	TFC	I	01, 03
2023	EPICHLOROHYDRIN	6.1	TF1	II	01, 03
2205	ADIPONITRILE	6.1	T1	III	01, 03
2487	PHENYL ISOCYANATE	6.1	TF1	I	01, 02, 03, 04
2831	1,1,1-TRICHLOROETHANE	6.1	T1	III	01, 03
Liabile to crystallization					
1605	ETHYLENE DIBROMIDE	6.1	T1	I	01
1662	NITROBENZENE	6.1	T1	II	01, 02, 03, 04
2021	2-CHLOROPHENOL	6.1	T1	III	01, 02, 04
2218	ACRYLIC ACID, STABILIZED	8	CF1	II	01
2238	CHLOROTOLUENES (p-CHLOROTOLUENE)	3	F1	III	01, 02
Liabile to polymerization					
1092	ACROLEIN, STABILIZED	6.1	TF1	I	01, 03
1218	ISOPRENE, STABILIZED	3	F1	I	01, 03
1280	PROPYLENE OXIDE	3	F1	I	03
1919	METHYL ACRYLATE, STABILIZED	3	F1	II	01, 03
2348	n-BUTYL ACRYLATE, STABILIZED	3	F1	III	01, 02, 03

3.3.2.4 Certificate of approval

A certificate of approval should be chosen from numbers 001, 002, 003 and 004. The choice must correspond to the situation description.

ADN certificate of approval No. 01

1. Name of vessel: ALBAN
2. Official ENI number: 04010000
3. Type of vessel: Motor tanker
4. Type of tank vessel: C
5. Condition of cargo tanks: ~~1. Pressure cargo tanks^{1,2}~~,
2. Closed cargo tanks^{1,2},
~~3. Open cargo tanks with flame arresters^{1,2}~~,
4. Open cargo tanks^{1,2}
6. Types of cargo tank: ~~1. Independent cargo tanks^{1,2}~~,
2. Integral cargo tanks^{1,2},
~~3. Cargo tanks distinct from the hull^{1,2}~~
7. Opening pressure of high-velocity vent valves/~~safety valves~~: 50 kPa^{1,2}
8. Additional equipment:

Sampling device	
Possibility of a connection	Yes/ no ^{1,2}
Sampling opening	Yes/ no ^{1,2}
Water-spray system	
Internal pressure alarm 40 kPa	Yes/ no ^{1,2}
Cargo heating system	
Possibility of cargo heating from shore	Yes/ no ^{1,2}
Cargo heating installation on board	Yes/ no ^{1,2}
Cargo refrigeration system	Yes /no ^{1,2}
Inerting facilities	Yes /no ^{1,2}
Pump-room below deck	Yes /no ¹
Pressure relief device in rear housing	Yes/ no ^{1,2}
Gas supply/return line according to 9.3.2.22.5(c) ^{1,2}	
Piping and installation heated	Yes/ no ^{1,2}
Conforms to the rules of construction resulting from the remark(s) ... in column (20) of Table C of Chapter 3 ^{1,2}	
9. Electrical equipment:

Temperature class:	T4
Explosion group:	IIB
10. Loading rate: 800 m³/h
11. Permitted mass density: 1.50
12. Additional observations:¹

	The possibility of a sampling connection is appropriate for DOPAK, DPM-1000
--	---

ADN certificate of approval No. 02

1. Name of vessel: BALBA
2. Official ENI number: 04020000
3. Type of vessel: Motor tanker
4. Type of tank vessel: C
5. Condition of cargo tanks: ~~1. Pressure cargo tanks^{1,2}~~
2. Closed cargo tanks^{1,2}
~~3. Open cargo tanks with flame arresters^{1,2}~~
~~4. Open cargo tanks^{1,2}~~
6. Types of cargo tank: ~~1. Independent cargo tanks^{1,2}~~
2. Integral cargo tanks^{1,2}
~~3. Cargo tanks distinct from the hull^{1,2}~~
7. Opening pressure of high-velocity vent valves/~~safety valves~~: 30 kPa^{1,2}
8. Additional equipment:

Sampling device	
Possibility of connection	Yes/ no ^{1,2}
Sampling opening	Yes/ no ^{1,2}
Water-spray system	
Internal pressure alarm 40 kPa	Yes/ no ^{1,2}
Cargo heating system	
Possibility of cargo heating from shore	Yes/ no ^{1,2}
Cargo heating installation on board	Yes/ no ^{1,2}
Cargo refrigeration system	
Yes/ no ^{1,2}	
Inerting facilities	
Yes/ no ^{1,2}	
Pump-room below deck	
Yes/ no ^{1,2}	
Pressure relief device in rear housing	
Yes/ no ^{1,2}	
Gas supply/return line according to 9.3.2.22.5(c) ^{1,2}	
Piping and installation heated	Yes/ no ^{1,2}
Conforms to the rules of construction resulting from the remark(s) ... in column (20) of Table C of Chapter 3 ^{1,2}	
9. Electrical equipment

Temperature class:	T3
Explosion group:	IIB
10. Loading rate: 800 m³/h
11. Permitted mass density: 1.50
12. Additional observations:¹

	The possibility of a sampling connection is appropriate for HERMetic Sampler, partly closed
--	---

ADN certificate of approval No. 03

1. Name of vessel: CALDEZ
2. Official ENI number: 04030000
3. Type of vessel: Motor tanker
4. Type of tank vessel: C
5. Condition of cargo tanks:
 1. Pressure cargo tanks^{1,2}
 - ~~2. Closed cargo tanks^{1,2}~~
 - ~~3. Open cargo tanks with flame arresters^{1,2}~~
 - ~~4. Open cargo tanks^{1,2}~~
6. Types of cargo tank:
 1. Independent cargo tanks^{1,2}
 - ~~2. Integral cargo tanks^{1,2}~~
 - ~~3. Cargo tanks distinct from the hull^{1,2}~~
7. Opening pressure of high-velocity vent valves/~~safety valves~~: 400 kPa^{1,2}
8. Additional equipment:

Sampling device	
Possibility of a connection	Yes/ no ^{1,2}
Sampling opening	Yes /no ^{1,2}
Water-spray system	
Internal pressure alarm 40 kPa	Yes /no ^{1,2}
Cargo heating system	
Possibility of cargo heating from shore	Yes/ no ^{1,2}
Cargo heating installation on board	Yes /no ^{1,2}
Cargo refrigeration system	Yes /no ^{1,2}
Inerting facilities	Yes /no ^{1,2}
Pump-room below deck	Yes /no ¹
Pressure relief device in rear housing	Yes /no ^{1,2}
Gas supply/return line according to 9.3.2.22.5(c) ^{1,2}	
Piping and installation heated	Yes /no ^{1,2}
Conforms to the rules of construction resulting from the remark(s) ... in column (20) of Table C of Chapter 3 ^{1,2}	
9. Electrical equipment

Temperature class:	T4
Explosion group:	IIB
10. Loading rate: 800 m³/h
11. Permitted mass density: 1.00
12. Additional observations:¹

	The possibility of a sampling connection is appropriate for DOPAK, DPM-1000
--	---

ADN certificate of approval No. 04

1. Name of vessel: DALDORF
2. Official ENI number: 04040000
3. Type of vessel: Motor tanker
4. Type of tank vessel: C
5. Condition of cargo tanks: ~~1. Pressure cargo tanks^{1,2}~~,
2. Closed cargo tanks^{1,2},
~~3. Open cargo tanks with flame arresters^{1,2}~~,
4. Open cargo tanks^{1,2},
6. Types of cargo tank: ~~1. Independent cargo tanks^{1,2}~~,
2. Integral cargo tanks^{1,2},
~~3. Cargo tanks distinct from the hull^{1,2}~~,
7. Opening pressure of high-velocity vent valves/~~safety valves~~: 25 kPa^{1,2}
8. Additional equipment:

Sampling device	
Possibility of a connection	Yes/ no ^{1,2}
Sampling opening	Yes/ no ^{1,2}
Water-spray system	
Internal pressure alarm 40 kPa	Yes /no ^{1,2} Yes/no ^{1,2}
Cargo heating system	
Possibility of cargo heating from shore	Yes/ no ^{1,2}
Cargo heating installation on board	Yes /no ^{1,2}
Cargo refrigeration system	
	Yes /no ^{1,2}
Inerting facilities	
	Yes/no ^{1,2}
Pump-room below deck	
	Yes /no ¹
Pressure relief device in rear housing	
	Yes/no ^{1,2}
Gas supply/return line according to 9.3.2.22.5(c) ^{1,2}	
Piping and installation heated	Yes/ no ^{1,2}
Conforms to the rules of construction resulting from the remark(s) ... in column (20) of Table C of Chapter 3 ^{1,2}	
9. Electrical equipment

Temperature class:	T2
Explosion group:	IIA
10. Loading rate: 800 m³/h
11. Permitted mass density: 1.10
12. Additional observations:¹

	The possibility of a sampling connection is appropriate for HERMetic Sampler, closed
--	--

The candidate has 90 minutes to complete this part of the examination. The maximum number of points is 30. The distribution of the points shall be set by the examination committee prior to the examination in accordance with the degree of difficulty of the questions.

The examination shall be marked in accordance with ADN section 8.2.2.7.2.5.

Multiple-choice questions on chemicals

These questions can be found in documents ECE/TRANS/WP.15/AC.2/2009/21, 22 and 24 to 26.

Substantive questions on chemicals

These questions can be found in document ECE/TRANS/WP.15/AC.2/2011/7, Part I.

Examples of substantive questions

I. Example of a substantive question - Gas

Situation description:

Your GASEX motor tanker has a 001 certificate of approval. The tank vessel contains UN No. 1011 BUTANE; the pressure in the cargo tank is 0.2 bar (gauge).

At terminal 1 the vessel is to be loaded to the maximum with UN No. 1086 VINYL CHLORIDE, STABILIZED, class 2, classification code 2F, and it is later be unloaded at terminal 2.

Loading port = terminal 1

The substance to be loaded is stored in spherical tanks.

The terminal can deliver a nitrogen flow of up to 1,000 m³/h at a maximum pressure of 5 bar (gauge) and has a flare stack with a capacity of 1,000 m³/h.

During loading the vapours/gas must not be returned to the on-shore spherical tank.

The terminal's loading flow is 250 m³/h.

The temperature of the substance and the ambient temperature are both 10° C.

Unloading port = terminal 2

The vessel is unloaded with the on-board pumps. The greatest possible quantity must be unloaded.

The substance is unloaded into a spherical storage tank. A gas return line is available.

The ambient temperature is 10° C.

During the examination, the texts of the regulations and technical literature referred to in 8.2.2.7 may be consulted.

The following documents are at your disposal:

- Certificate of approval No. 001

- Equipment description for the GASEX motor tanker

- Information sheets on the properties of both substances

- Safety data sheets on both substances

ADN certificate of approval No.: 001

1. Name of vessel: GASEX
2. Official number: 04090000
3. Type of vessel: motor tanker
4. Type of tank vessel: G
5. Cargo tank designs
 1. Pressure cargo tanks^{1,2}
~~2. Closed cargo tanks^{1,2}~~
~~3. Open cargo tanks with flame arresters^{1,2}~~
 4. Open cargo tanks^{1,2}
6. Types of cargo tanks
 1. Independent cargo tanks^{1,2}
~~2. Integral cargo tanks^{1,2}~~
~~3. Cargo tank wall distinct from the hull^{1,2}~~
7. Opening pressure of ~~high velocity vent valves~~/safety valves^{1,2}: 1,580 kPa
8. Additional equipment:
- | | |
|--|-----------------------------------|
| Sampling device | |
| connection for a sampling device | Yes/ no ^{1,2} |
| sampling opening | Yes /no ^{1,2} |
| Water-spray system | Yes/ no ^{1,2} |
| internal pressure alarm 40 kPa | Yes /no ^{1,2} |
| Cargo heating system: | |
| possibility of cargo heating from shore | Yes /no ^{1,2} |
| cargo heating installation on board | Yes /no ^{1,2} |
| Cargo refrigeration system | Yes /no ^{1,2} |
| Inerting facilities | Yes/ no ^{1,2} |
| Cargo pump-room below deck | Yes /no ^{1,2} |
| Pressure device in the accommodation | |
| at the stern of the vessel | Yes /no ^{1,2} |
| Gas supply/return line according to ^{1,2} | |
| piping and installation heated | Yes /no ^{1,2} |
- Conforms to the rules of construction resulting from the remark(s) of column (20) of Table C of Chapter 3.2^{1,2}
9. Electrical equipment:
- | | |
|--------------------|-----|
| Temperature class: | T4 |
| Explosion group: | IIB |
10. Loading rate: ---
11. Permitted relative density: 1.00
12. Additional observations:¹ The connection for a sampling device can be used with an ETS.

Technical equipment of the GASEX motor tanker

- A. Cargo tanks
 - Number: 6
 - Volume per cargo tank: 250 m³
 - Minimum authorized temperature: - 10° C
- B. Pumps: 1 submerged pump per cargo tank
- C. Compressors: 2 compressors
- D. Piping systems: separate for liquids and gases (vapours)
- E. Possibility of longitudinal flushing: yes

Substance properties BUTANE

Name: BUTANE	UN number: 1011
Formula: C ₄ H ₁₀	
Boiling point: -0.5° C	Molar mass: $M = 58$ (58.123)
Ratio between the vapour density and that of air = 1 (15° C): 2.01	
Flammable mixture, vol.%: 1.1 - 8.5	
Auto-ignition temperature: +365° C	Critical temperature: +152° C
Maximum permissible concentration at the workplace: 600 ppm	

<i>Vapour-liquid equilibrium</i>			
t [°C]	p_{\max} [bar]	ρ_L [kg/m ³]	ρ_G [kg/m ³]
- 10	0.70	611.9	1.90
- 5	0.85	606.5	2.27
0	1.03	601.1	2.72
5	1.24	595.6	3.23
10	1.48	590.1	3.81
15	1.76	584.4	4.49
20	2.07	578.7	5.23
25	2.43	572.9	6.09
30	2.83	566.9	7.04
35	3.27	560.9	
40	3.77	554.7	
45	4.32	548.5	
50	4.93	542.0	

Substance properties VINYL CHLORIDE, STABILIZED

Name: VINYL CHLORIDE, STABILIZED	UN number: 1086
Formula: C ₂ H ₃ Cl	
Boiling point: -14° C	Molar mass: $M = 62.50$
Ratio between the vapour density and that of air = 1 (15° C): 2.16	
Flammable mixture, vol.%: 4 - 26	
Auto-ignition temperature: +415° C	Critical temperature: +158.4° C
Maximum permissible concentration at the workplace: --- ppm*	

* Vinyl chloride, stabilized, is carcinogenic.

<i>Vapour-liquid equilibrium</i>			
t [°C]	p_{\max} [bar]	ρ_L [kg/m ³]	ρ_G [kg/m ³]
- 10	1.16	962.3	3.5
- 5	1.40	954.8	4
0	1.69	947.3	5
5	2.02	939.7	6
10	2.40	931.9	7
15	2.83	924.1	8
20	3.33	916.1	9
25	3.89	907.9	11
30	4.52	899.6	13

<i>Preparation of loading operations</i>	A - 1
Give a short list of at least five general safety requirements applicable before a loading operation begins.	
	Points:
<i>Preparation of loading operations</i>	A - 2b
What concentration of BUTANE can remain in the cargo tanks before loading begins?	
	Points:
<i>Preparation of loading operations</i>	A - 4/1
For the substance being loaded, is an entry required in the transport document, and if so, which?	
	Points:
<i>Flushing of cargo tanks</i>	B - 2
What flushing method do you choose, and why?	
	Points:
<i>Flushing of cargo tanks</i>	B - 6
What pressure should be reached in the cargo tanks after flushing, and why?	
	Points:
<i>Flushing of cargo tanks</i>	B - 10
If your vessel is coming from the shipyard, how do you test the gastightness of the piping system and the cargo tanks?	
	Points:
<i>Loading</i>	C - 1
Explain precisely how you load the first amounts of goods into your tank or tanks at the beginning of the loading procedure and why you proceed in this manner; (As a gas (vapour)? A liquid? One cargo tank at a time, or several at the same time? Using the piping used for flushing, or the bottom piping?)	
	Points:
<i>Loading</i>	C - 4
During loading, do you return gas or nitrogen? If so, where? If not, why not?	
	Points:
<i>Loading</i>	C - 5
What personal protective equipment must be worn by persons connecting and disconnecting the loading and unloading piping and the gas return piping? Cite the source in ADN.	
	Points:
<i>Loading</i>	C - 7
What pressure do you expect to find in the cargo tanks after loading is completed?	
	Points:
<i>Load calculation</i>	D - 1
Calculate the total mass of the liquid loaded, in kg. (Write the entire method of calculation and not just the answer.)	
	Points:

<i>Load calculation</i>	D - 2
Calculate the total mass of the gas, in kg. (Write the entire method of calculation and not just the answer.)	
Points:	

<i>Load calculation</i>	D - 3
Calculate the total mass loaded. (Write the entire method of calculation and not just the answer.)	
Points:	

<i>Unloading</i>	E - 1
Describe how you would efficiently unload (leaving minimal residual quantities) so as to discharge as much of the goods as possible.	
Points:	

<i>Unloading</i>	E - 2
What final pressure do you expect after unloading as completely as possible?	
Points:	

II. Example of a substantive question - Chemicals

Situation description:

Your motor tanker has certificate of approval 01.

Your assignment is to transport 1,500 tons of **UN No. 1662 NITROBENZENE, class 6.1, classification code T1, packing group II.**

Your motor tanker is empty. The previous cargo was **UN 2205 ADIPONITRILE, class 6.1, classification code T1, packing group II.**

The outside temperature during loading is +9° C.

During the examination, the texts of the regulations and technical literature referred to in 8.2.2.7 may be consulted.

The following documents are at your disposal:

- Certificate of approval No. 001

- Safety data sheets on both substances

ADN certificate of approval No.: 01

1. Name of vessel: ALBAN
2. Official ENI number: 04010000
3. Type of vessel: Motor tanker
4. Type of tank vessel: C
5. Condition of cargo tanks:
 1. ~~Pressure cargo tanks~~^{1,2}
 2. Closed cargo tanks^{1,2}
 3. ~~Open cargo tanks with flame arresters~~^{1,2}
 4. ~~Open cargo tanks~~^{1,2}
6. Types of cargo tank
 1. ~~Independent cargo tanks~~^{1,2}
 2. Integral cargo tanks^{1,2}
 3. ~~Cargo tanks distinct from the hull~~^{1,2}
7. Opening pressure of high-velocity vent valves/~~safety valves~~: 50 kPa^{1,2}
8. Additional equipment:

Sampling device	
possibility of a connection	Yes/ no ^{1,2}
sampling opening	Yes/ no ^{1,2}
Water-spray system	
internal pressure alarm 40 kPa	Yes/ no ^{1,2}
Cargo heating system	
possibility of cargo heating from shore	Yes/ no ^{1,2}
cargo heating installation on board	Yes/ no ^{1,2}
Cargo refrigeration system	Yes /no ^{1,2}
Inerting facilities	Yes /no ^{1,2}
Pump-room below deck	Yes /no ¹
Pressure relief device in rear housing	Yes/ no ^{1,2}
Gas supply/return line according to 9.3.2.22.5(c) ^{1,2}	
piping and installation heated	Yes/ no ^{1,2}
Conforms to the rules of construction resulting from the remark(s) ... in column (20) of Table C of Chapter 3 ^{1,2}	
9. Electrical equipment:

Temperature class:	T4
Explosion group:	IIB
10. Loading rate: 800 m³/h
11. Permitted mass density: 1.50
12. Additional observations:¹ The possibility of a sampling connection is appropriate for DOPAK, DPM-1000

<i>Loading (including preparation)</i>	A - 3
The cargo tanks of your tank vessel were emptied but probably not cleaned of the previous product (see introduction). What must you do from the point of view of safety before taking on new cargo? Please provide the source in ADN.	
Points:	
<i>Loading (including preparation)</i>	A - 6
During loading, the vapour pipe is connected to the shore facility. What determines the maximum loading rate and what is the maximum permissible loading rate? Please justify your answer and provide the source in ADN.	
Points:	
<i>Loading (including preparation)</i>	A - 10
At what percentage must a level alarm and overflow prevention device be triggered? Please provide the source in ADN.	
Points:	
<i>Substance-related question</i>	E - 1
At the current outside temperature, can you load this substance in your vessel? Please justify your answer and provide the source in ADN.	
Points:	
<i>Transport</i>	B - 2
Name eight documents that must, as a minimum, be kept on board during transport under ADN.	
Points:	
<i>Transport</i>	B - 3
You wish to call near a residential area during the voyage. What is the minimum distance that you must observe if there is no available berthing area designated by the competent authority? Please provide the source in ADN.	
Points:	
<i>Transport</i>	B - 6
During the carriage of certain goods, persons under 14 years of age are not authorized on board. Is this requirement applicable to UN No. 1662 NITROBENZENE? Please provide the source in ADN.	
Points:	
<i>Substance-related question</i>	E - 8
During the transport of this substance you note on the pressure gauge that the pressure is rising in the cargo tank. What should you do to prevent excess pressure?	
Points:	

<i>Loading (including preparation)</i>	C - 1
During unloading, you hear crackling noises from the discharge pump on the deck.	
(a) What could be causing this?	
(b) What must you do?	
Points:	
<i>Loading (including preparation)</i>	C - 5
What must you attend to above all during the unloading of the cargo tanks?	
Please justify your answer.	
Points:	
<i>Loading (including preparation)</i>	C - 9
Under ADN, what is the maximum number of litres of residual cargo a cargo tank and its piping may contain when it is emptied by an additional stripping installation?	
Please provide the source in ADN.	
Points:	
<i>Flushing</i>	D - 1
Under ADN, under what conditions may one enter a cargo tank without protective equipment?	
Please provide the source in ADN.	
Points:	
<i>Flushing</i>	D - 4
You degas while the vessel is under way. Near the wheelhouse you measure a concentration of 25% below the lower explosive limit of the substance. Should you do anything and, if so, what?	
Please provide the source in ADN.	
Points:	
<i>Flushing</i>	D - 10
The gas concentration must be measured once an hour in the first two hours after the beginning of the degassing operation. Who should take these measurements?	
Please provide the source in ADN.	
Points:	
<i>Substance-related question</i>	E - 12
What is the major hazard posed by this substance and what are the subsidiary hazards?	
Explain the types of hazard and provide the source in ADN.	
Points:	