Digitaler TestAS

Preparatory Materials for Test Takers

TestAS
Test for Academic Studies

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Test for Academic Studies

Imprint

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Contents

Instructions for the use of the preparation materials for test takers

Dear TestAS participant,

these preparation materials will help you to prepare well for the digital TestAS exam. Here you get

- general information on the content and structure of the test,
- detailed instructions and hints on how to work through the different task types as well as
- the possibility to work on exercises for each task type in different levels of difficulty including sample solutions.

Read all the information carefully to become well acquainted with the digital TestAS. The preparation materials are primarily intended to help you to prepare for the exam in terms of content. You can get hints and examples on the digital form of the test in information videos on www.testas.de.

Note

The detailed instructions for the individual task types are only available in these preparation materials! In the digital TestAS exam you will only see short explanations of the processing as a reminder.

We wish you lots of success!

Your TestAS team

General Information about the digital TestAS

The digital TestAS is a study aptitude test used for the admission of international applicants to undergraduate degree programmes in Germany. Taking the test allows a fair comparison of applicants across different national education systems.

The digital TestAS is offered digitally and can be taken in both German and English. Developed in close professional collaboration with German universities, the test accurately reflects the requirements for the fields of study Humanities, Cultural Studies and Social Sciences, Life Sciences, Mathematics, Informatics and Natural Sciences, Engineering Sciences, Economics and Medicine and is thus a valid instrument for assessing the study ability of applicants.

The digital TestAS is evaluated centrally at the TestDaF Institute in Bochum. The test is standardized, which ensures that all participants can be compared with each other. In addition, the format of the test is based on the internationally recognized standards for psychodiagnostic tests, the test is reliable and objective.

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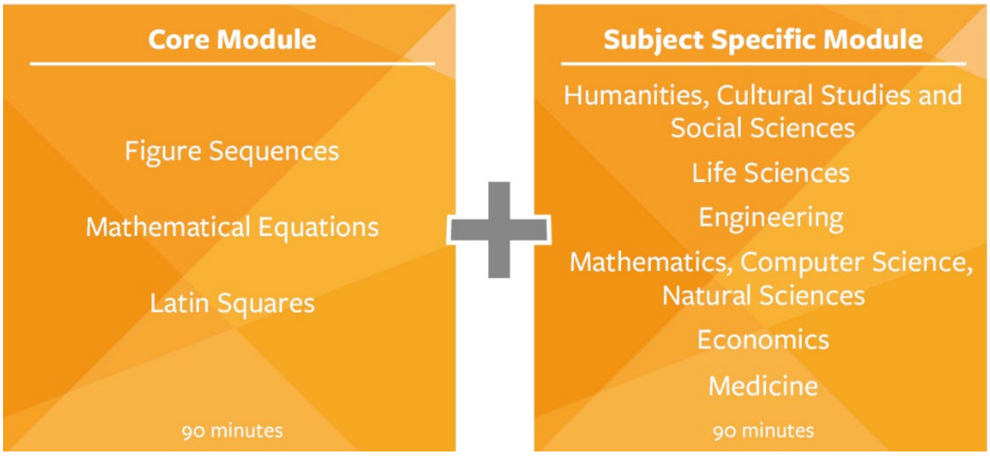
Structure of the digital TestAS

The digital TestAS consists of two examination parts: the Core Module tests the general aptitude to study, the field of study-related modules test the field of study-specific aptitude. The Subject Modules offered can be seen in the following diagram.



The duration of the exam itself is about three hours with a break of 30 minutes between the two parts of the exam.

The **Core Module** measuring general study ability consists of three subtests that measure general cognitive abilities relevant to a bachelors's degree programme in Germany. To a certain extent, the core module allows participants to be compared across the respective subject modules.

The production of the **Subject Modules** is based on extensive scientific studies by experts, so that the exam content is representative of the respective fields of study. The examination tasks consist of a combination of a typical subject-related problem (input) and corresponding single-choice questions. You can familiarize yourself with the exact requirements and instructions of the individual task types in the next sections.

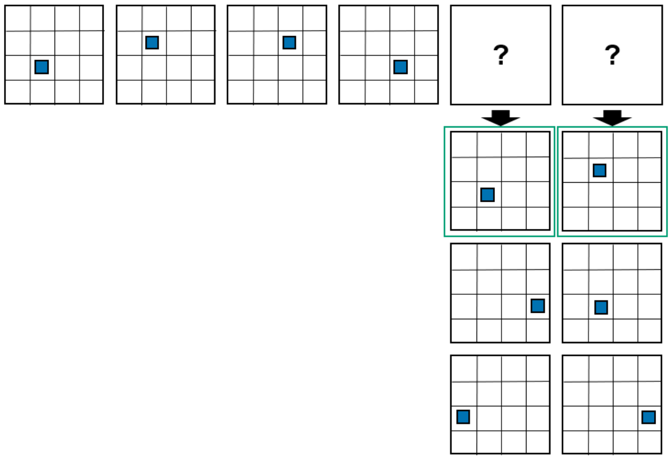
Please note: You may not take notes throughout the exam.

Core Module – Instructions and Exercises

Core Module	Figure Sequences
Instructions	

In this task you will see a series of pictures (matrices). The figures in the matrices can change their **position**, **colour**, and/or **orientation** from one matrix to the next according to specific rules. It is your task to continue the series logically and to determine what the next two matrices look like.

Example Task

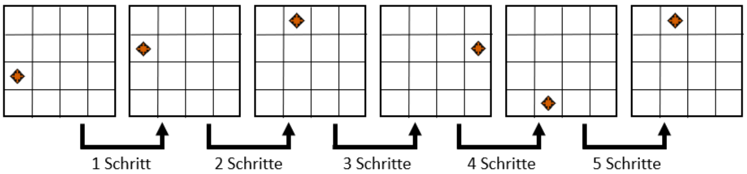


Solution

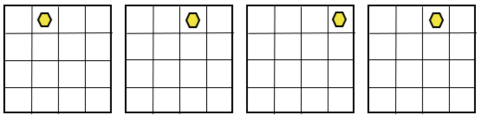
The blue square always moves one field clockwise within the four middle fields. Therefore, for the fifth matrix the first response option is correct, and for the sixth matrix as well.

Rules

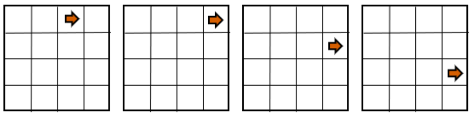
- Figures can change their colour.
- Figures can rotate around their own axis.
- Figures can move in the matrix. Vertical, horizontal, and diagonal movements are allowed. Figures cannot change from one diagonal movement to another type of movement.
- Figures can also change their movement, color, or orientation by x + 1. Example: If a figure moves one step from matrix 1 to matrix 2, it moves 2 steps from matrix 2 to matrix 3, then 3 steps, etc.



- Figures cannot disappear or overlap.
- Figures cannot leave the matrix. If they come up against an outer boundary, they can EITHER
- bounce off OR



- move along the outer boundary.



In the exam you have a total of **25 minutes** for **20** series of matrices. Please be as quick and accurate as possible. If you do not know an answer, please guess which answer might be correct. You are not allowed to take notes in the exam.

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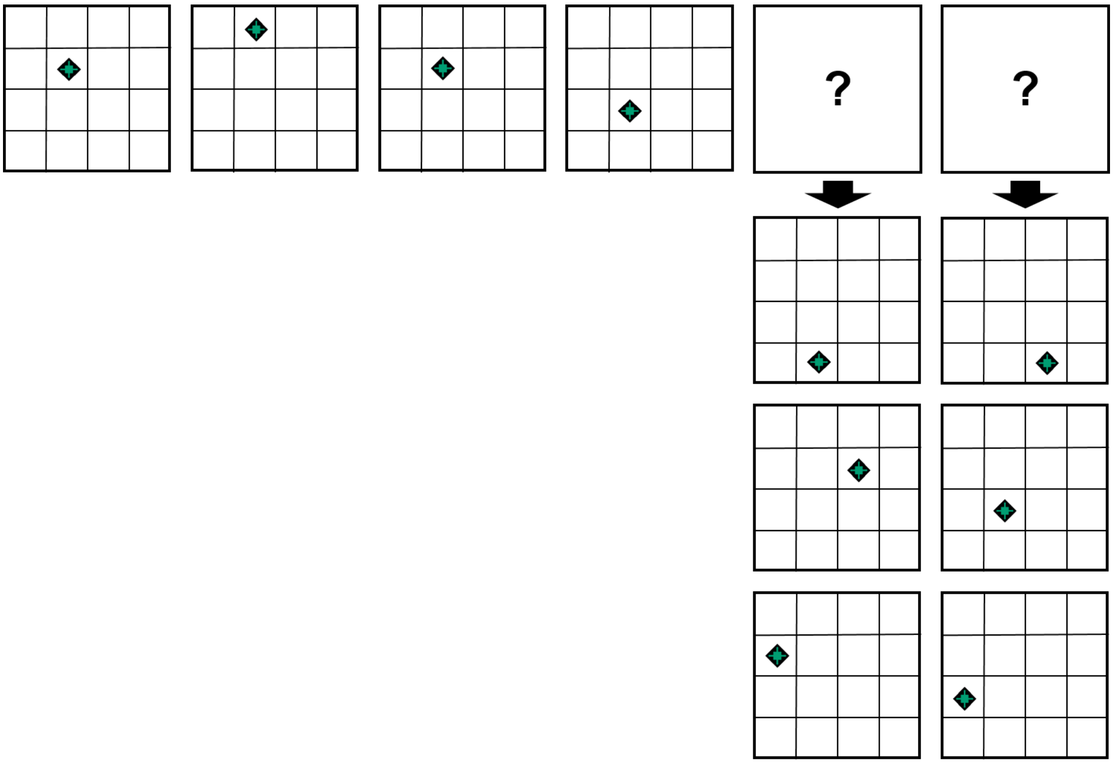
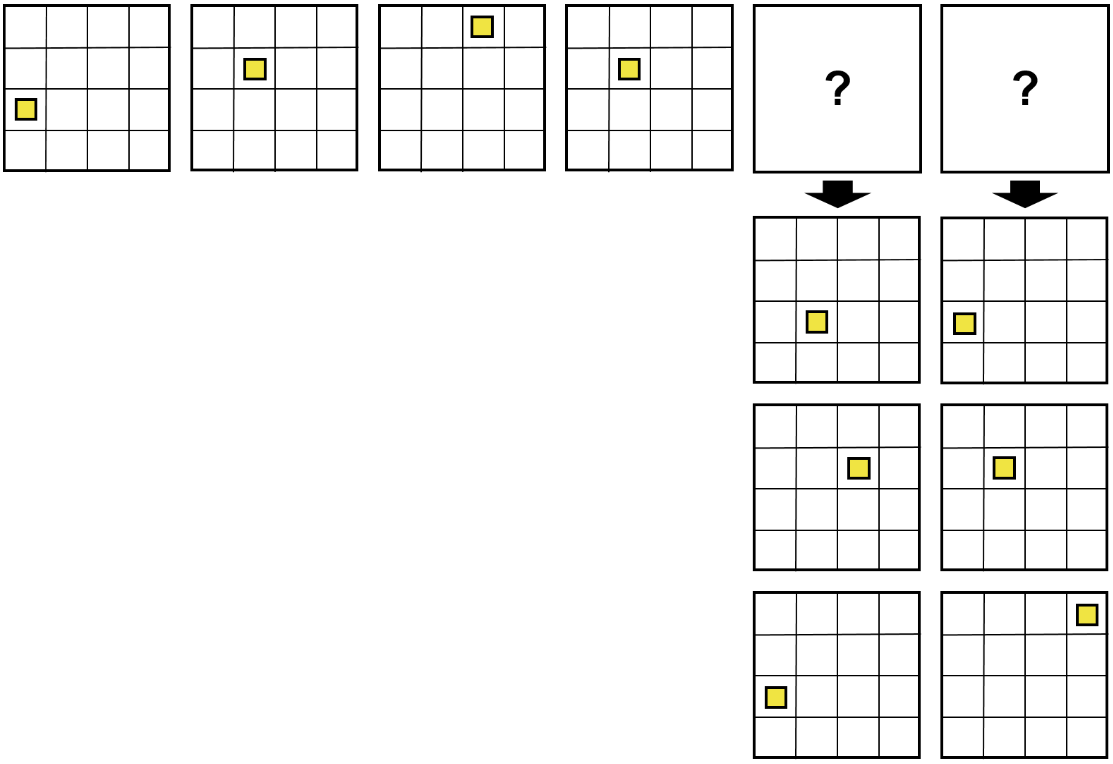
Core Module	Figure Sequences
Exercises	

For the task type **Figure Sequences** there are six exercises available, two each in the difficulty levels low, medium and high. On the following pages you can see the solutions including the solution paths. Practice with these exercises without taking notes, as you will not have any helping tools available to you in the exam either.

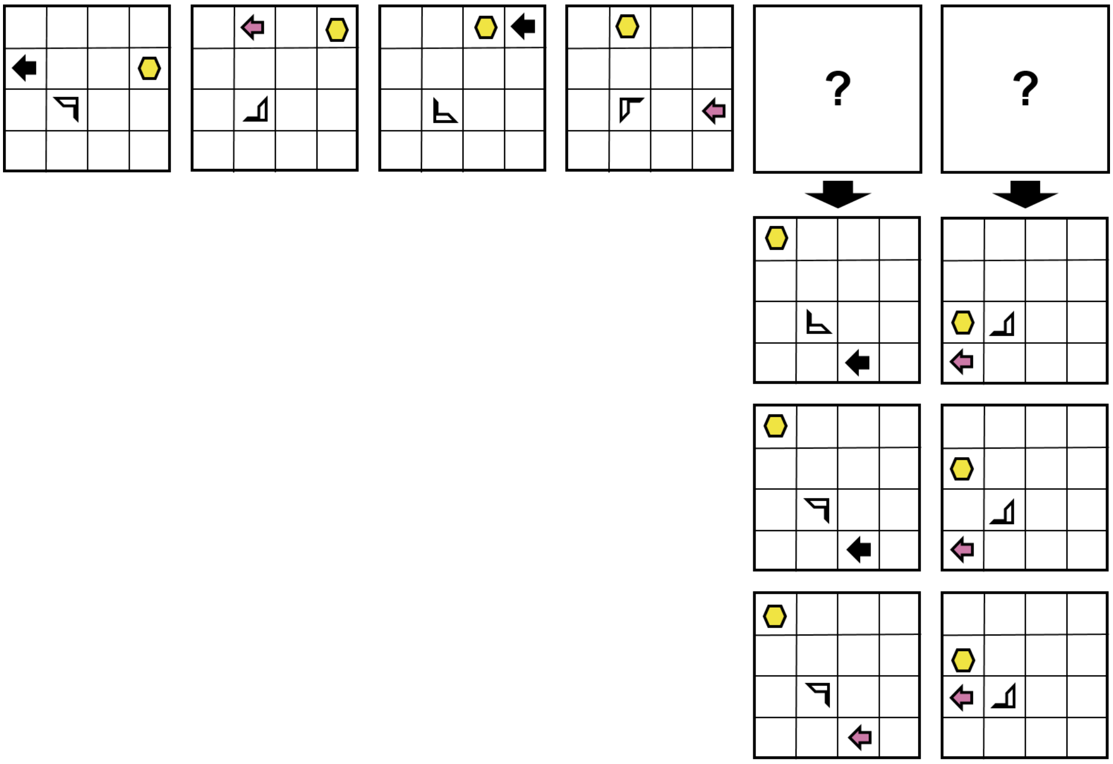
Exercise 1 – Difficulty: low



Exercise 2 – Difficulty: low



Exercise 3 – Difficulty: medium



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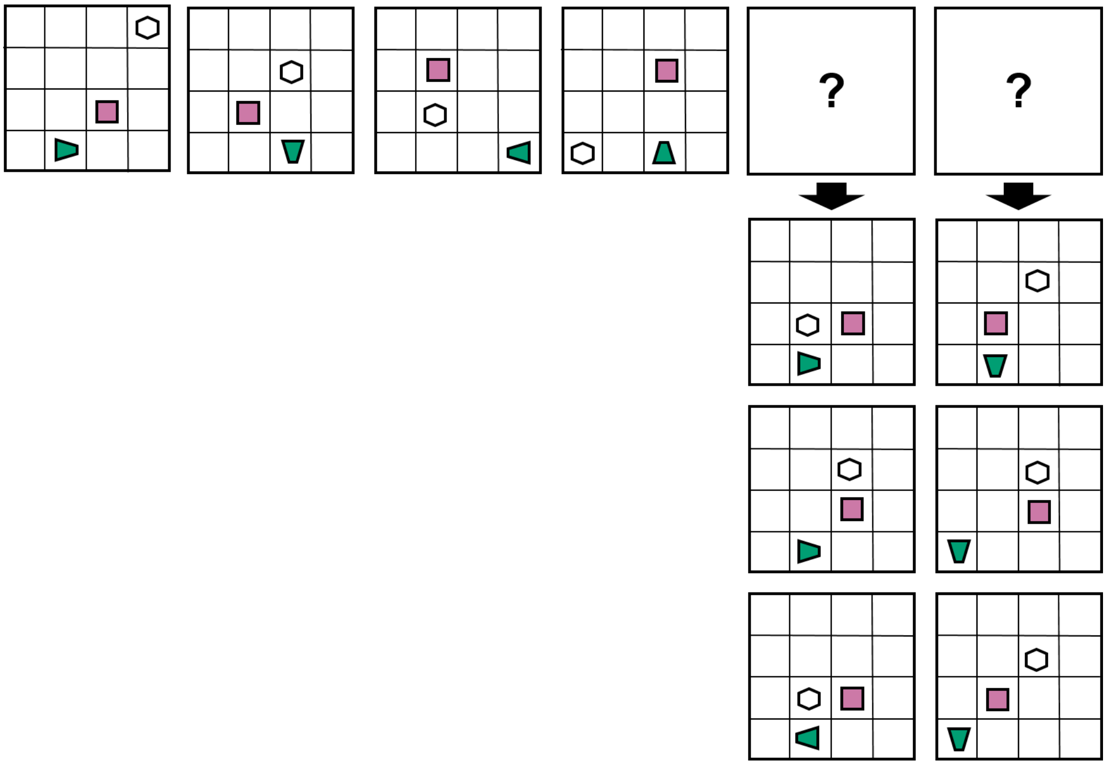
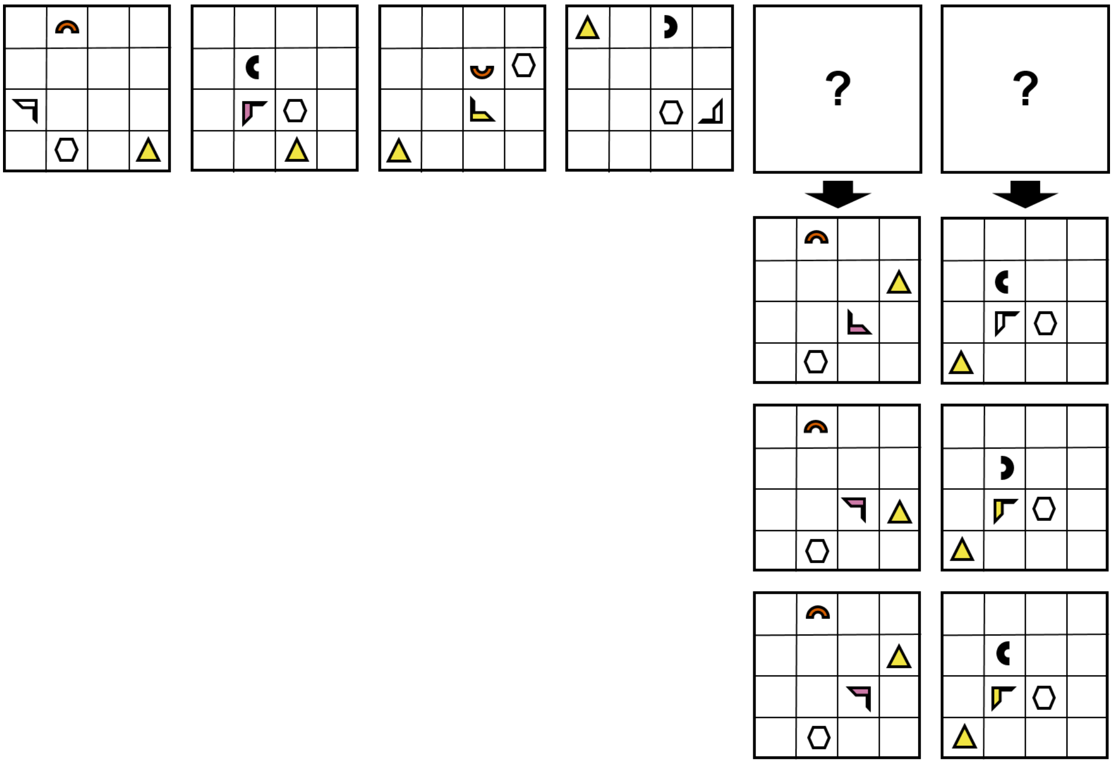
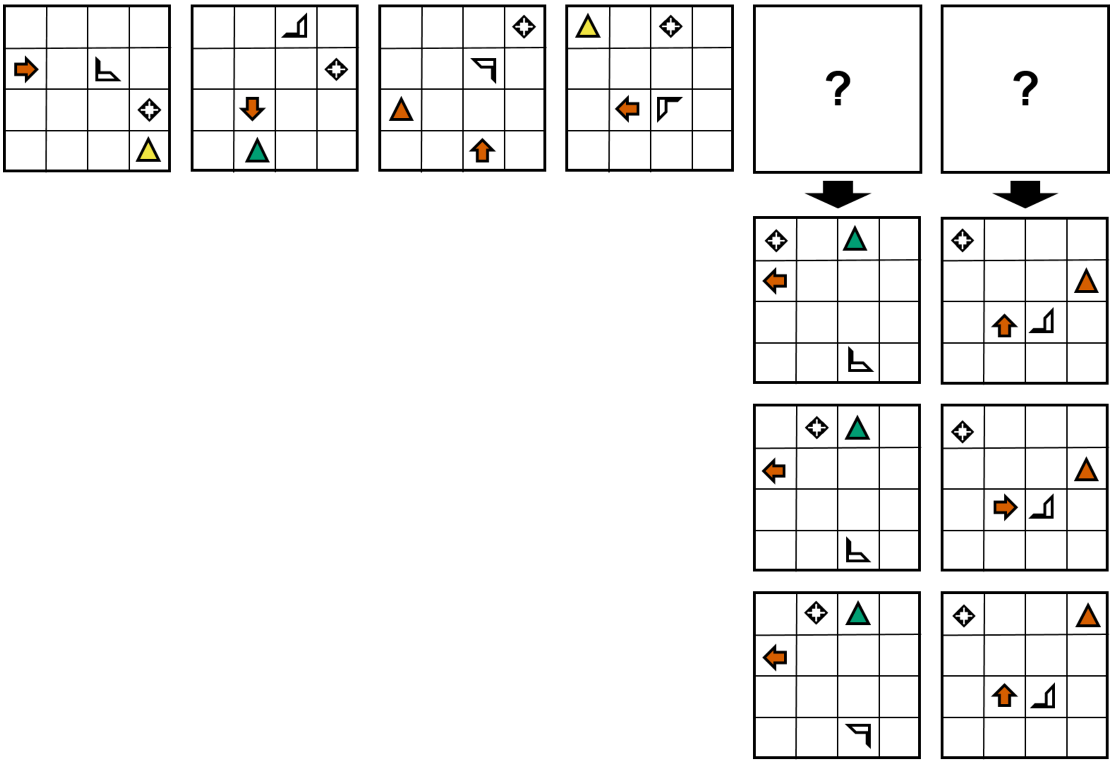
Exercise 4 – Difficulty: medium



Exercise 5 – Difficulty: high



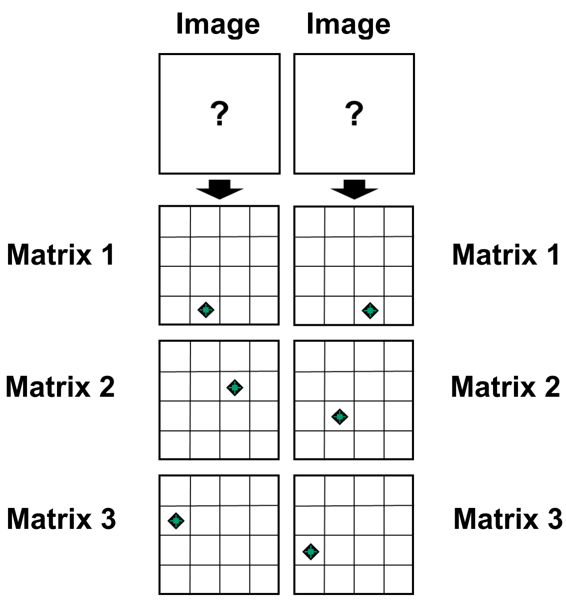
Exercise 6 – Difficulty: high



Core Module **Figure Sequences**

Exercises – Solutions

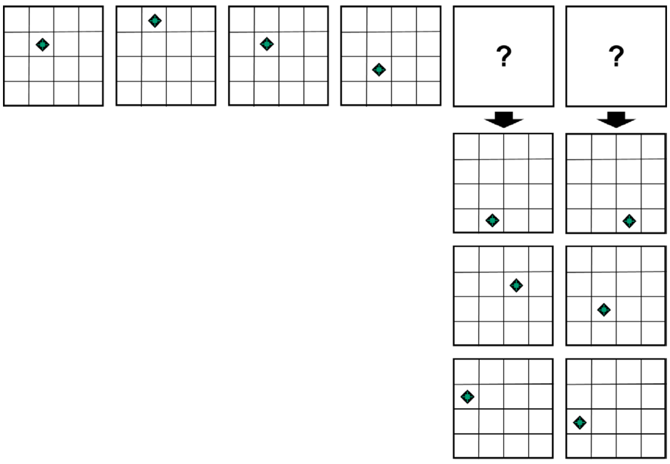
Note on the solution key



Solution – Exercise 1

Image 1: Matrix 1

Image 2: Matrix 2

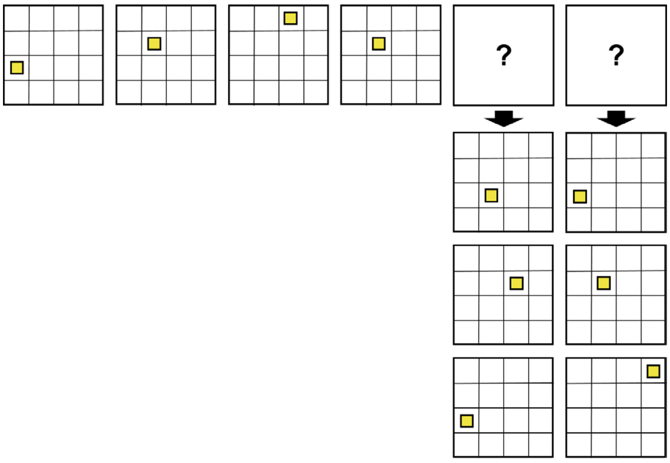


The symbol  moves vertically one field at a time in the second column and bounces off the upper or lower boundary.

Solution – Exercise 2

Image 1: Matrix 3

Image 2: Matrix 2

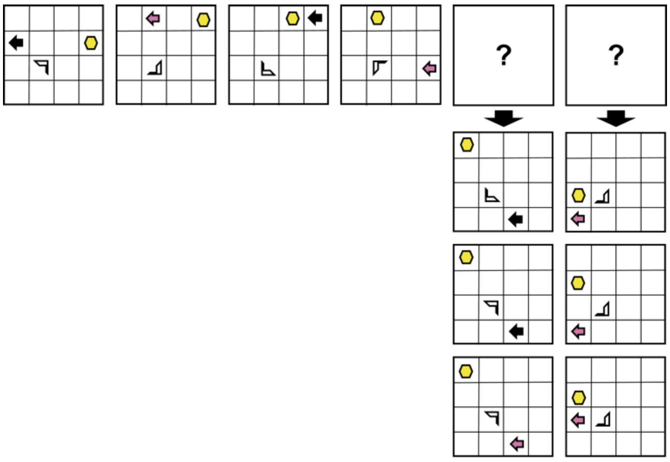


The symbol always moves one space diagonally upwards to the right from its starting position until it bounces off the upper boundary and returns to the starting position in the same way (diagonally downwards to the left). Once there, it bounces off the lower boundary and moves diagonally upwards to the right again.

Solution – Exercise 3

Image 1: Matrix 2

Image 2: Matrix 2



The symbol moves along the outer borders clockwise by two squares at a time. It changes its colour alternately from black to pink .

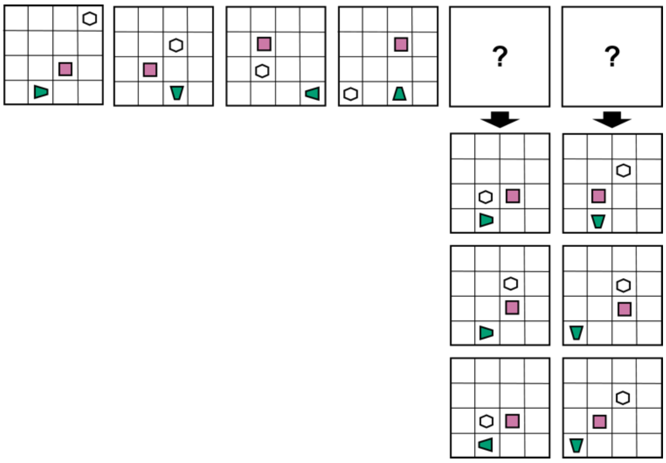
The symbol rotates 90 degrees to the right from image to image.

The symbol moves along the outer borders counter clockwise one space at a time.

Solution – Exercise 4

Image 1: Matrix 1

Image 2: Matrix 3



The symbol  moves horizontally by one field in the fourth row and bounces off the right or left border. It rotates 90 degrees to the right from image to image.

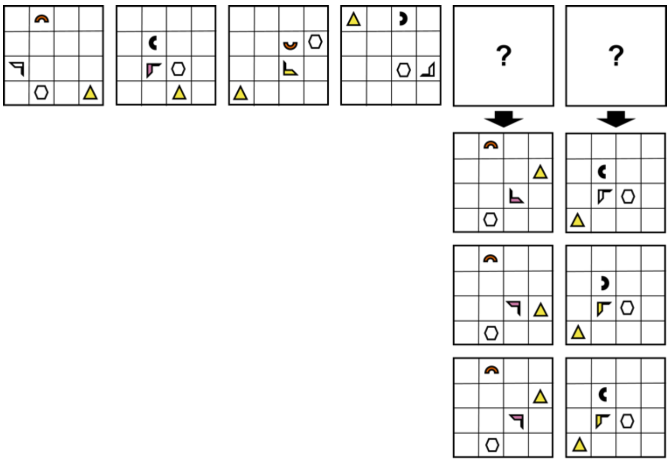
The symbol  moves from its starting position one field at a time from image to image. The order of the directions in which the symbol moves is: left, up, right, down, and so on.

The symbol  moves from its starting position diagonally downwards to the left until it bounces off the bottom left corner and returns the same way to the top right corner (diagonally upwards to the right).

Exercise – Solution 5

Image 1: Matrix 3

Image 2: Matrix 3



The symbol  moves along the outer borders clockwise by x + 1 fields (i.e. from matrix 1 to matrix 2 one field, from matrix 2 to matrix 3 two fields, and so on).

The symbol  moves horizontally by one field in the third row and bounces off the right or left border. In doing so, it turns 90 degrees to the left from image to image and changes its colour from white  to pink  to yellow , and so on.

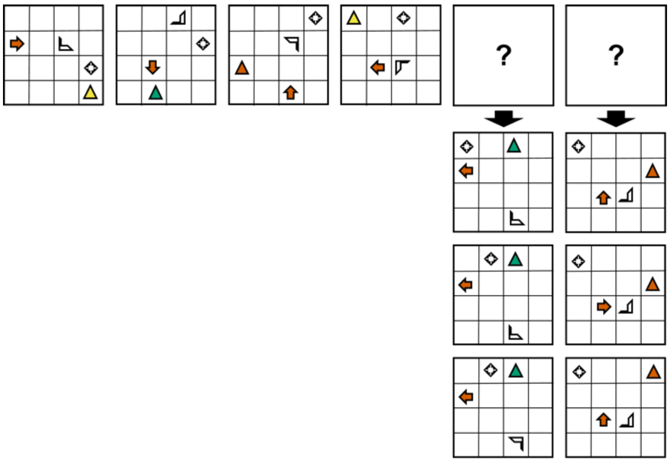
The symbol moves from its starting position one field at a time from image to image. The sequence of directions in which the symbol moves is: down, right, up, left, and so on. It turns 90 degrees to the left and changes its colour alternately from orange to black.

The symbol moves diagonally upwards to the right from its starting position until it bounces off the right boundary and returns to the starting position in the same way (diagonally downwards to the left). Once there, it bounces off the lower boundary and moves diagonally upwards to the right again.

Solution – Exercise 6

Image 1: Matrix 2

Image 2: Matrix 1



The symbol moves from its starting position diagonally downwards to the right until it bounces off the lower boundary and returns to the starting position in the same way (diagonally upwards to the left). Once there, it bounces off the left boundary and moves diagonally down to the right again. The symbol always turns x + 1 times to the right by 90 degrees. I.e. from matrix 1 to matrix 2 it rotates once by 90 degrees to the right. From matrix 2 to matrix 3 it rotates twice by 90 degrees to the right, and so on.

The symbol moves vertically by one field in the third column and bounces off the upper or lower border. It rotates 90 degrees to the left from image to image.

The symbol moves along the outer borders counter clockwise one space at a time.

The symbol moves along the outer borders clockwise by two spaces at a time. In the process, it changes colour from yellow to green to orange, etc.

Core Module	Mathematical Equations
Instructions	

In this task, you are supposed to solve systems of equations in such a way that all requirements are met. One system of equations always consists of several single equations.

Your task is to find out which numbers must be used for the unknowns (letters) in the equations so that all equations are correct.

There is always only one solution for each letter, in which all requirements are met.

Each letter can be an integer between 1 and 20.

Example 1

$\mathbf{A} + 2 = \mathbf{B}$

$\mathbf{B} = 6$

What number does **A** correspond to so that the equations are solved correctly?

Solution of Example 1

Because of the second equation, you know that **B** = 6. Replace **B** with the number 6 in the first equation and you get **A** + 2 = 6. Solve the first equation and you get **A** = 6 – 2 = 4. Therefore, the solution of the first example is **A** = 4. Any other solution is wrong.

Example 2

$\mathbf{B} = 2 \times \mathbf{A}$

$\mathbf{B} + \mathbf{A} = 12$

What numbers do **A** and **B** correspond to so that the equations are solved correctly?

Solution of Example 2

The first equation defines that **B** = 2 × **A**. Putting this information in the second equation gives 2 × **A** + **A** = 12 or 3 × **A** = 12. Rearranging this equation gives **A** = 12 ÷ 3 = 4. Putting the number 4 into the first or second equation for **A** gives **B** = 8. Therefore, the solution of the second example is **A** = 4 and **B** = 8. Any other solution is wrong.

In the exam you have **25 minutes** to solve **20 systems of equations**. Please be as quick and accurate as possible. You can try to guess, if you do not know an answer. You are not allowed to take notes in the exam.

Core Module	Mathematical Equations
Exercises	

For the task type **Mathematical Equations**, six exercises are available, two each in the difficulty levels low, medium and high. On the following pages you can see the solutions including the solution paths. Practice with these exercises without taking notes, as you will not have any helping tools available to you in the exam either.

Exercise 1 – Difficulty: low

$7 + A = 14$
$B - 3 = A$

Exercise 2 – Difficulty: low

$B \div 2 = A$
$B - A = 8$

Exercise 3 – Difficulty: medium

$3 \times C = A$
$A + C = 8$
$2 \times A + 2 \times C = B$

Exercise 4 – Difficulty: medium

$18 - B = A$
$3 \times A = C$
$B \div 2 = A$

Exercise 5 – Difficulty: high

$A - B + C - D = 2$
$10 \times B = C$
$5 \times B = A$
$11 + B = D$

Exercise 6 – Difficulty: high

$C + D - A = 1$
$5 \times C = D$
$13 - C = A$
$3 \times C - 1 = B$

Solution – Exercise 1

7 + A = 14
B – 3 = A

A = 7
B = 10

The first equation makes it clear that A = 7 if you subtract 7 on both sides. If you insert this information into the second equation, you get B - 3 = 7. If you add 3 on both sides, you get the solution B = 10.

Solution – Exercise 2

B ÷ 2 = A
B – A = 8

A = 8
B = 16

Multiplying by 2 on both sides in the first equation gives B = 2A. Replacing the variable B in the second equation with this information gives 2A - A = 8. This means A = 8. Substituting the solution for A in the first equation gives B ÷ 2 = 8. Multiplying both sides by 2 gives B = 16.

Solution – Exercise 3

3 × C = A
A + C = 8
2 × A + 2 × C = B

A = 6
B = 16
C = 2

With the information from the first equation (3 × C = A or A = 3C), A can be replaced in the second equation so that it can be solved for C: 3C + C = 8 or 4C = 8. If you divide by 4 on both sides, you get C = 2. Thus, the solution of A can be calculated by substituting the value of C into the first equation: 3 × 2 = A. Therefore, A = 6. By substituting the solutions for A and C, the third equation can be solved for B: 2 × 6 + 2 × 2 = B. Therefore, B = 16.

Solution – Exercise 4

$18 – B = A$
$3 \times A = C$
$B \div 2 = A$

$A = 6$
$B = 12$
$C = 18$

If you multiply by 2 on both sides in the third equation, you get $B = 2A$ (alternatively, you can also continue the calculation with $0.5B = A$, for example). If you replace B with this information in the first equation, you get $18 - 2A = A$. If you add 2A on both sides, you get $18 = 3A$. If you now divide by 3, you get $A = 6$. This information can be inserted into the third equation, so that you get $B \div 2 = 6$. If you multiply by 2 on both sides, you get $B = 12$. If you insert the result for A into the second equation, you get $3 \times 6 = C$, so $C = 18$.

Solution – Exercise 5

$A – B + C – D = 2$
$10 \times B = C$
$5 \times B = A$
$11 + B = D$

$A = 5$
$B = 1$
$C = 10$
$D = 12$

The information given in equations two, three and four for the variables A, B and C can be inserted into the first equation so that it can be solved for B: $5B - B + 10B - (11 + B) = 2$. If you dissolve the bracket, you get $5B - B + 10 B - 11 - B = 2$ or $13B - 11 = 2$. If you add 11 on both sides, you get $13B = 13$. If you divide by 13, you get the solution $B = 1$. This information can be inserted into the other equations and solved for the respective missing variable: $10 \times 1 = C$ or $C = 10$, $5 \times 1 = A$ or $A = 5$ and $11 + 1 = D$ or $D = 12$.

Solution – Exercise 6

$C + D - A = 1$
$5 \times C = D$
$13 - C = A$
$3 \times C - 1 = B$

$A = 11$
$B = 5$
$C = 2$
$D = 10$

The information given in equations two and three for the variables A and D can be inserted into the first equation, so that it can be solved for C: $C + 5C - (13 - C) = 1$. Dissolving the bracket gives $C + 5C - 13 + C = 1$ or $7C - 13 = 1$. Adding 13 on both sides gives $7C = 14$. Dividing by 7 gives the solution $C = 2$. This information can be inserted into the other equations and solved for the respective missing variable: $5 \times 2 = D$ or $D = 10$, $13 - 2 = A$ or $A = 11$ and $3 \times 2 - 1 = B$ or $B = 5$.

Core Module — Latin Squares

Instructions

In this task you will see a 5x5 grid (a square containing 5 rows and 5 columns).

Some fields of the grid contain letters. Each letter can only appear once in each row and each column. Only the letters that are shown as response options (the row next to the grid) can appear in the grid.

Your task is to decide which letter belongs in the field with the question mark. Sometimes you need to fill in other fields in your mind before you can figure out what letter should replace the question mark.

If you know what the correct solution for the question mark field is, click on the correct response in the solution row.

	?			
	A			
	E			
	D			
C	B			

A
B
C
D
E

Next, you will see two examples.

Example 1

			D	
			A	
			C	
C	D	A	?	
			E	D

A
B
C
D
E

➡

			D	
			A	
			C	
C	D	A	B	
			E	D

A
B
C
D
E

Solution of Example 1

In the first example, “B” needs to replace the red question mark, because all other letters D, A, C, and E already appear in this column.

Example 2

A	E	C	D	
				A
				E
				?
	B			C

A
B
C
D
E

➡

A	E	C	D	B
				A
				E
				D
	B			C

A
B
C
D
E

Solution of Example 2

In the second example, you first need to fill in “B“ in the first row of the last column. “B” is the only letter, which does not already appear in this row and column. Then you can replace the question mark with “D”, because it is the only letter that does not appear in the last column.

In the exam you have 20 minutes for 16 tasks. Please be as quick and accurate as possible! If you do not know an answer, please guess which answer might be correct. You are not allowed to take notes in the exam.

Exercises –Solutions

For the task type **Latin Squares**, six exercises are available, two each in the difficulty levels low, medium and high. On the following pages you can see the solutions including the solution paths. Practice with these exercises without taking notes, as you will not have any helping tools available to you in the exam either.

Exercise 1 – Difficulty: low

B	?	A	D	
A	B	E	C	
	A			
C				
D	E		B	

Exercise 2 – Difficulty: low

		?		
			D	A
		E		D
A	D			B
D	B		C	

Exercise 3 – Difficulty: medium

A			B	
	B	A		
	E	D		
E	C		A	D
		E		?

Exercise 4 – Difficulty: medium

	E		C	B
?			A	
		A	E	D
B	A		D	
	D	C		

Exercise 5 – Difficulty: high

			C	
	C	?	E	
	E		B	C
A	B		D	E
	D	E	A	

Exercise 6 – Difficulty: high

?				C
	D	E	B	A
B		D	A	
	B	C		D

Note on the solution key

	α	β	γ	δ	ε
1	B	?	A	D	
2	A	B	E	C	
3		A			
4	C				
5	D	E		B	

Solution – Exercise 1

Solution = C

B	?	A	D	
A	B	E	C	
	A			
C				
D	E		B	

Solution path:

- In column β, C and D are missing.
- C is already in row 4, so D must be inserted in β4.
- Consequently, C must be inserted in the place of the question mark.

Solution – Exercise 2

Solution = D

		?		
			D	A
		E		D
A	D			B
D	B		C	

Solution path:

- In the place of the question mark, D must be inserted because D is already given in all other columns and rows.

Solution – Exercise 3

Solution = B

A			B	
	B	A		
	E	D		
E	C		A	D
		E		?

Solution path:

- In column γ, B and C are missing. At position γ4, only B can be inserted, since there is already a B in row 1. This also applies in γ4, or line 4 vice versa for C. Consequently, only a C can be inserted in γ1.
- A and D are missing in column β. A can only be in position β5, because A is already present in row 1. Consequently, only a D can be in position β1.
- From this follows that only E can be inserted in ε1.
- In row 3 it is now noticeable that A can only be in position ε3, as it is already present in all columns and rows.
- Since a B still has to be inserted in column ε, and there is already a B in line 2, it can only be inserted at the position of the question mark.

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Solution – Exercise 4

Solution = D

	E		C	B
?			A	
		A	E	D
B	A		D	
	D	C		

Solution path:

- A and D are missing in the first row. A can only be inserted at position α1, since it is already in column γ. Consequently, D must be in position γ1.
- It is now noticeable that D is already present in four different rows and columns and can thus only be used in the place of the question mark.

Solution – Exercise 5

Solution = D

			C	
	C	?	E	
	E		B	C
A	B		D	E
	D	E	A	

Solution path:

- Only C can be inserted at position γ4.
- In row 3, A and D are missing. At position γ3, only an A can be inserted because it is already present in column α. Consequently, only a D can be inserted at position α3.
- Only A can be inserted at position β1.
- Only E can be inserted at position α1, as it is already present in all other rows and columns.
- Furthermore, C and B are missing in row 5, whereby only a C is inserted at position α5, since it is already present in column ε. Consequently, there is a B at position ε5.

- In row 1, D and B are still missing. Since B is already in column ε, B must be inserted at position γ1 and D at position ε1.
- At the position of the question mark, D must be inserted, since all other letters are already present in column γ.

Solution – Exercise 6

Solution = E

?				C
	D	E	B	A
B		D	A	
	B	C		D

Solution path:

- At position α3, only a C can be inserted, since all other letters are already in line 3.
- In row 5, A and E are missing. A must be in position α5 because it is already in column δ. Consequently, E is in position δ5.
- In row 4, C and E are missing. Only a C can be inserted at position β4, as it is already present in column ε. Consequently, there is an E at position ε4.
- At position ε2, only a B can be inserted, as all other letters in column ε are already present.
- In column γ, A and B are missing. At position γ1, only a B can be inserted, since there is already a B in the second row. Consequently, A must be inserted in γ2.
  In the first row, A, D and E must be inserted. A must be inserted in β1 because it is already present in all the other columns. Since E is already present in column δ, it must therefore be inserted in the position of the question mark.

Subject Module – Instructions and Exercises

Subject Module

General Instructions

In this task type you see a text and a number of questions which you have to answer. There are 4 answer options for each question.

For each question, there is only one correct solution.

The text, the questions and the answer options may contain figures, tables and formulas.

For working on the entire subject test in the exam, you have 90 minutes in total. If you do not know an answer, please guess which answer might be correct. You are not allowed to take notes in the exam.

For practice and illustration of the subject module tasks, two sample tasks for each subject module are presented below.

Subject Module	Humanities and Cultural Sciences
Exercise 1	

Methods of Social Studies: Observation

Scientific observation in social research differs from daily observation. Scientific observation is defined as the systematic recording, capturing, and interpreting sensually perceptible behaviour at the time of its occurrence. Goals of scientific observation are: Description and reconstruction of social reality with regard to a guiding research question, recording social reality through systematic perceptual processes, and the control of the results through scientific discussion. Within this framework, systematic procedures are developed and used in consideration of valid “standards”.

Observation is a process-active procedure that demands high social and technical competence from the researchers. Observation is recording and interpretation social action as well as social action itself. Particularly through the discipline of ethnology and through colonization in the 19th century, participant observation and field studies received decisive impulses that led to their broad application.

Observations can be used in social research *quantitatively* as well as *qualitatively*. Quantitative observation is based on the principle that social reality is given as objective and can be recorded with controlled methods. Accordingly, empirical research collects theory-based data about social reality. To do this, observation must meet the following criteria: *Reliability* (dependability), *validity* (Is the target construct captured?), *representativeness*, and *verifiability*.

Qualitatively based observation corresponds to the assumption that social actors ascribe meanings to objects and do not behave according to fixed norms and rules, but interpret situations and social reality in a processual way. The following research principle serve as a common basis: Openness (no pre-developed theories and hypotheses: The object of investigation determines the research), process character of object and research (social actors create a reality through constant interpretation and negotiation), reflexivity (theories and concepts are generated in the research process), flexibility (flexible approach), explication of approach (prior theoretical knowledge must be disclosed), communication and problem orientation (the research question results from what is perceived).

Exercise 1

What is the purpose of scientific observation?

a. The use of established practices.
b. The orientation of the actors in the world.
c. The reconstruction of social reality.
d. The capture of theoretical reality.

Exercise 2

Which of the following statements is correct?

a. Scientific observation is the procedure by which "standards" are developed.
b. Scientific observation is the perception of the results of scientific discussions.
c. Scientific observation is the systematic perceiving, recording, and interpreting at the time of its occurrence.
d. Scientific observation is the systematic reality that creates social behaviour.

Exercise 3

How are results of scientific observation controlled?

a. Through confrontation with social reality
b. Through scientific discussions
c. Through changing processes of perception
d. Through changing social realities

Exercise 4

What does observation <u>not</u> require?

a. Interventions in situations
b. Research principles
c. Social competence
d. Processuality

Exercise 5

What is quantitatively based observation?

a. Controlled methods for creating reality.
b. Theory-based interpretation of situations in social hot spots.
c. A representation of what is theoretically understood as social reality.
d. A measurement of reality understood to be objective and recorded by controlled methods.

Exercise 6

What is an assumption of qualitatively based observation?

a. Research determines the object of study and the social reality that is observed.
b. Social actors move rigidly according to norms and rules in social reality.
c. Social actors interpret situations and thus constitute social reality in a processual manner.
d. The reality that is observed is not influenced by the actors.

Exercise 1

Solution: C

The description of the observation process as a reconstruction of social reality can be found quite similarly in the text.

Exercise 2

Solution: C

The text contains the following passages on the definition of scientific observation: "...recording social reality through systematic perceptual processes...", "Observation is recording and interpretation social action as well as social action itself". This results in answer C as the correct answer.

Exercise 3

Solution: B

The text contains the following passages on the definition of scientific observation: "...and the control of the results through scientific discussions.". This results in answer B as the correct answer.

Exercise 4

Solution: A

The emphasis on a systematic approach to observation, the consideration of valid "standards" and the criteria of reliability, validity, representativeness and verifiability can be understood as research principles. For qualitative observation, research principles are explicitly mentioned in the text. Answer B cannot therefore be correct. The processuality of observations and the need for social competence are also mentioned in the text. Answers C and D can therefore also be excluded.

Exercise 5

Solution: D

The reader learns that social actors create reality in the section on qualitative observation. Answer A is therefore not correct. Quantitative observation requires an interpretation of the data collected about the situation, not the situation itself. Furthermore, quantitative observation is independent of the place where it is carried out. Answer B is therefore also incorrect. Answer C can be excluded, since an observation cannot be made without prior theoretical knowledge, but it should describe what is found in reality, not what is assumed in it. Answer D reflects the second sentence of the section on quantitative observation and is therefore correct.

Exercise 6

Solution: C

Answer C describes the central assumption of qualitative observation as described in the first sentence of the corresponding text section. The statements in answer options A, B and D can also be excluded, they are in direct opposition to the statements listed in the same text section.

Subject Module	Humanities and Cultural Sciences
Exercise 2	

Sociology: Parsons and values

The US sociologist Talcott Parsons (1902-1979) put forward the following theory: Individuals attach meaning to things and actions. This meaning is considered a *value*. For society, values represent the framework that is necessary and conducive to maintaining social order.

Parsons developed the *action theory*, according to which every action is involved in three systems: the *cultural system*, the *social system* and the *personality system*. Parsons calls the cultural system the "value system" and ascribes to it a normative control function vis-à-vis the two other systems.

The social system is subordinated to the cultural system. It includes the ordering that determines how the actions of individuals are structured. This includes, for example, the family, an organisation or society. The normative culture represents the institutionalised patterns of society and other social systems.

The personality system subordinates itself to the social system. The members of the social system have internalised the normative culture; they encounter it in the form of role expectations.

Parsons subdivides society and other social systems into four levels of control over behaviour:

1. *Societal values* represent members' shared ideas about a desirable society.
2. *Differentiated norms* emerge in the differentiated social subsystems of a society through "value judgements" that members attribute to the characteristics and behaviours of other groups. In this way, certain social norms institutionalise themselves differently. This is a specification of the general system on a concrete level.
3. The *collectivity* is a differentiated unit within a social system, although it can also be a single individual who has a specific function. The normative culture here is based on the specific goals, situations and resources of the unit.
4. *Roles* represent the normative expectations placed on the individual by the system to ensure effective goal-directed action within the collectivity and the social system.

Exercise 1

What does not correspond to Parson's definition of values?

a. The meaning that individuals attach to things and actions.
b. Values correspond to the necessary and beneficial disorder of society.
c. The framework that maintains social order.
d. Values are to be defined on both an individual and societal level.

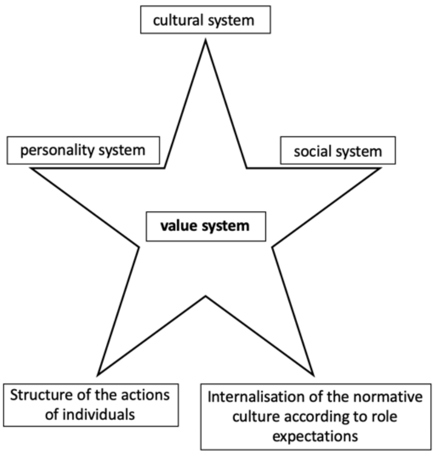
Exercise 2

Which system is not part of Parson's theory of general action systems?

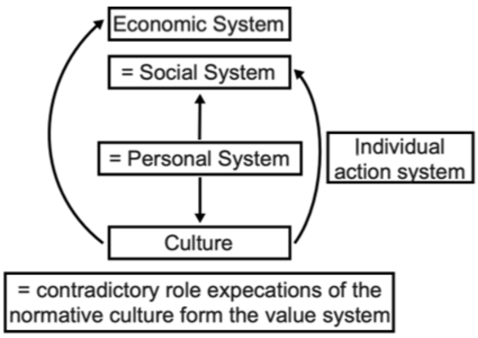
a. The cultural system
b. The social system
c. The personality system
d. The capital system

Exercise 3

Which diagram corresponds to Parson's theory of general action systems?



a.



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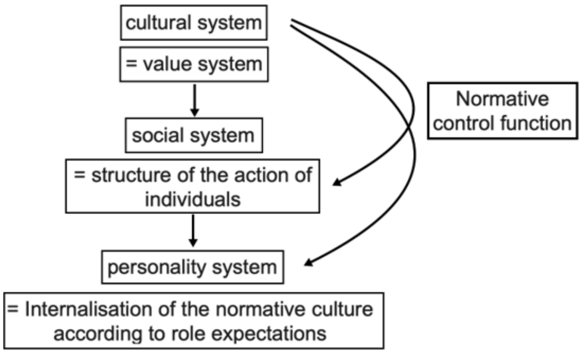
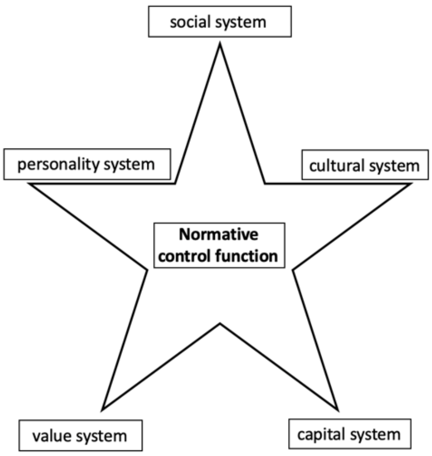


c.



d.

Exercise 4

What does Parsons mean by "social system"?

a. The system that subordinates itself to the personality system.
b. The order according to which behaviours of individuals are structured.
c. The level at which culture internalisation takes place in the individual.
d. The structure that confronts the individual with role expectations.

Exercise 5

Where do "differentiated norms" according to Parsons arise?

a. In the differentiated social subsystems of a society.
b. In the "prejudices" that members of a subsystem have towards the characteristics and behaviour of other groups.
c. In the characteristics and behaviours that apply in all subsystems of a society.
d. In the shared ideas of members regarding a desirable society.

Exercise 6

What does Parsons mean by "collectivity"?

a. Individuals who do not have a specific function.
b. The differentiated unit within a social system.
c. The use of resources with a specific goal.
d. The specification of the general system at the subsystem level.

Subject Module	Humanities and Cultural Sciences
Exercise 2 – Solutions	

Exercise 1

Solution: B

The task asks for a definition of values that does not fit. The description "Values correspond to the necessary and beneficial disorder of society" contradicts the following passage in the first paragraph of the text: "For society, values represent the framework that is necessary and conducive to maintaining social order".

Exercise 2

Solution: D

At no point in the text is reference made to a capital system.

Exercise 3

Solution: C

Answers A and D can be quickly ruled out. In both diagrams, a superordinate system is shown divided into five sub-areas. In the text, however, there is only a distinction between three systems, with the help of which Parsons describes society, and four levels of control. Neither of these fits with the five-member stars.

In Figure B, an economic system appears that was not described in the text. Furthermore, the central position of the Personal System does not fit with the statements in the text, where this system is described as subordinate to the Social System.

Figure C illustrates Parsons' theory very well. It illustrates the superior role of the cultural system over the social system and its superior role over the personal system.

Exercise 4

Solution: B

Solution A clearly contradicts the statement in the text at the beginning of the fourth section. Solution C can be ruled out because the internalisation of cultural values would not take place within the social system but within the personality system. Dealing with role expectations can also be assigned to the connection between the cultural system and the personality system, so it does not fit the social system either. The statement of solution B can be found in a similar formulation in the text at the beginning of the second section. Solution B is therefore the correct answer.

Exercise 5

Solution: A

The text speaks of "value judgements", not "prejudices". How prejudices are to be classified in the process of evaluation is not further explained in the text. Answer B is therefore not correct. Answers C and D describe processes that lead to social values, not to differentiated norms. The statement of answer A is found in the text, answer A is therefore correct.

Exercise 6

Solution: B

Only answer B agrees with the statements in the text.

Phenylketonuria family tree

Phenylketonuria (*PKU*) is a hereditary and congenital disorder. Individuals who have phenylketonuria lack a specific enzyme. This leads to an increased concentration of the amino acid phenylalanine. This can lead to, among other things, a disturbance in the development of the brain. One in about 10,000 newborns has phenylketonuria, with no difference between girls and boys. Since phenylketonuria is a hereditary disease, it often occurs in several family members.

Figure 1 shows a family tree. In this family tree, the incidence of the hereditary disease is marked in black.

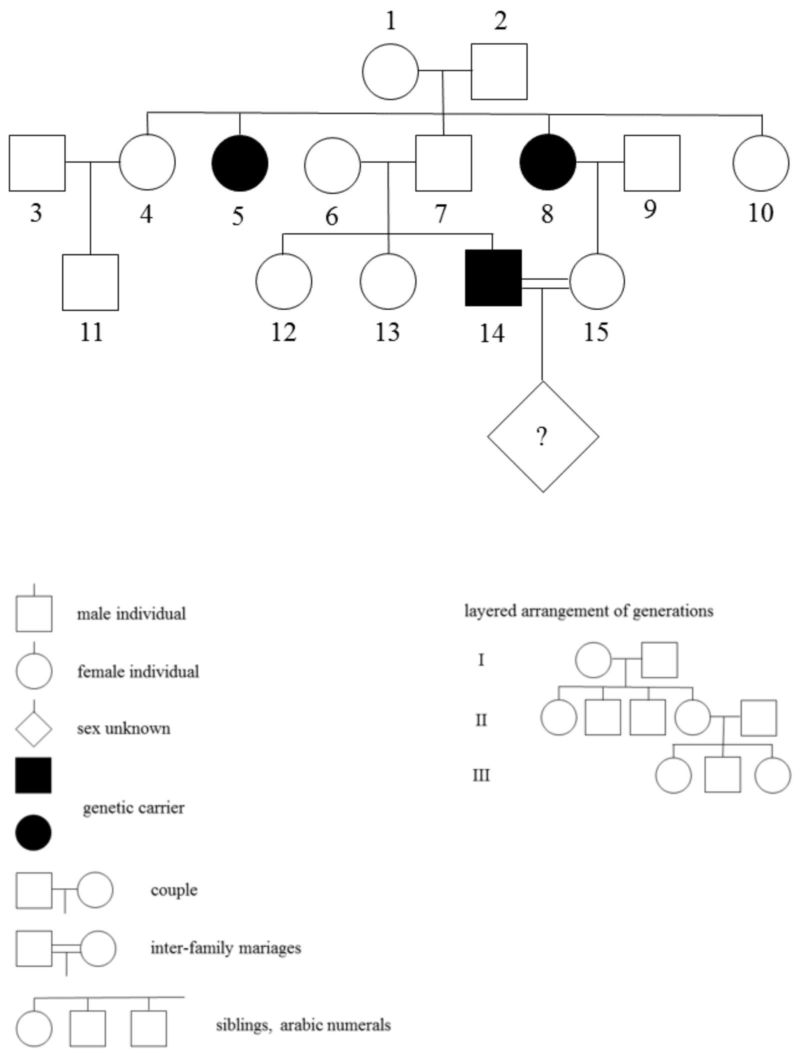


Figure 1. Family tree with the incidence of phenylketonuria.

People usually have two hereditary dispositions for a specific characteristic, for example, for a hereditary disease. These so-called alleles originate from the parents, with one from the mother and one from the father. If both alleles are the same for the formation of a trait, the organism is homozygous for this hereditary disposition; if the two alleles are different, the organism is heterozygous.

Exercise 1

Which of the following statements about individual no. 7 in the family tree is correct with respect to the trait phenylketonuria?

a. Individual no. 7 has two healthy alleles
b. Individual no. 7 is heterozygous
c. Individual no. 7 is a carrier of the trait
d. Individual no. 7 is homozygous

Exercise 2

What is the mode of inheritance in the hereditary disease phenylketonuria?

a. autosomal dominant mode of inheritance
b. x-linked recessive inheritance
c. autosomal recessive inheritance
d. x-linked dominant inheritance

Exercise 3

Why <u>can't</u> the genotype of individual no. 12 be stated with certainty?

a. Because the father is not a trait carrier
b. Because the genotype of the mother is unknown
c. Because individual no. 12 can be homozygous or heterozygous
d. Because the mother can be homozygous or heterozygous

Exercise 4

What is the statistical probability of a sick child for the parent couple consisting of individual no. 14 and individual no. 15?

a. 0,001%
b. 1%
c. 25%
d. 50%

Exercise 5

Individuals who are phenotypically healthy themselves but pass the trait on to their offspring are called conductors. What is the probability that parents who are both conductors will have a healthy child who is a conductor?

a. 25%
b. 50%
c. 75%
d. 100%

Exercise 6

If the couple consisting of individual no. 14 and individual no. 15 have two children, what is the statistical probability that both children will be sick?

a. 50 %
b. 25 %
c. 12,5 %
d. 6,25 %

Exercise 7

The disease phenylketonuria results from an abnormality in a single enzyme. There are several mutations, each of which causes the disease. The most common is a mutation in which there is a tryptophan instead of an arginine at position 408 in the polypeptide chain.

What type of mutation is phenylketonuria?

a. Inversion
b. Gene mutation
c. Genome mutation
d. Translocation

Subject Module	Life Sciences
Exercise 1 – Solutions	

Exercise 1

Solution: B

Statement B is correct, person no. 7 is heterozygous. From the fact that parents can pass on the disease to their children without having the disease themselves, it can be concluded that the disease is inherited recessively. Consequently, both inherited alleles must show the change if the disease occurs in a person. This is the case with person no. 14, the son of person no. 7, so the father must have an allele with the mutation.

Exercise 2

Solution: C

The mode of inheritance cannot be dominant, as the disease can also be inherited by non-sufferers. In the case of an x-linked recessive inheritance, only women would contract the disease. This is not the case. Therefore, answer C must be correct.

Exercise 3

Solution: C

Person No. 12 may have received both unchanged alleles from the parents, only the changed one from the father or only the changed one from the mother. In the first case, it would have a homozygous genotype, in the latter two a heterozygous one.

Exercise 4

Solution: D

The probability is 50%. The father carries two altered alleles. There is a 100% probability that the mother has an altered allele due to a parent with the disease. The probability that she will pass this on to a child is 50%.

Exercise 5

Solution: B

Conductors have a heterozygous genotype, i.e. they have an altered allele. For a child of a pair of conductors there are four possibilities with equal probability: it gets the unchanged allele of both parents, it gets the unchanged allele of the mother and the changed allele of the father, it gets the changed allele of the mother and the unchanged allele of the father, it gets the changed alleles of both parents. Each possibility occurs with a probability of 25%. But since possibilities two and three lead to the child itself becoming a conductor, the probability is 50%. Answer B is therefore correct.

Exercise 6

Solution: B

In both children, there is a 50% chance that they will get the altered allele of the mother. The father inherits an altered allele in every case. The combined probability that both children will get the disease is the product of the individual probabilities. It is therefore 25%.

Exercise 7

Solution: B

The way in which the disease develops is referred to as a gene mutation. Inversion and translocation refer to mutations that affect entire areas of chromosomes. In a genomic mutation, there is a change in the number of chromosomes.

Ideal Gas Law

The particles of a free gas move freely and chaotically in all directions in space. They are able to interact with each other in different ways. They can collide with each other and hence change their direction. However, when colliding, the total kinetic energy of the particles remains unchanged. As particles are not massless, they exert gravitational forces on each another. Likewise, due to random dipole moments in their atomic shells, electric forces of attraction arise. However, these gravitational and electrical forces are so small that they can be ignored when it comes to modelling an ideal gas. The model of an ideal gas aims to approximately describe real gases as precise as possible. It can also be applied to any desired compound of different gases.

In such a model, particles are only able to interact via collision. The particles are considered as point mass. They move chaotically in all directions in space.

The amount of substance *n* is a measure of the number of particles and is expressed using the international unit of moles. Consider a gas with a substance amount *n* with *n* mol of particles. Its physical properties can be described with three quantities: pressure, temperature, and volume. When taking the general gas constant *R* into account, the following energy balance (known as the ideal gas equation) results:

$$p \cdot V = n \cdot R \cdot T \tag{1}$$

p Pressure in *Pa*

V Volume in m^3

n Amount of Substance in *mol*

R Genereal Gas Constant $R = 8{,}314 \frac{J}{mol*K}$

T Temperature in *K*

Exercise 1

A gas is in a sealed, rigid vessel. The temperature of the gas increases. As a result, which quantity also changes?

a. The amount of substance n
b. The volume V
c. The pressure p
d. The general gas constant R

Exercise 2

A gas moves freely in a flexible vessel. The temperature of the gas increases. The pressure of the gas remains constant. Which of the following statements is correct?

a. The volume increases and the vessel expands.
b. The gas particles expand.
c. The vessel expands and the general gas constant R increases linearly with the temperature rise.
d. Due to the pressure constancy, the vessel remains unchanged.

Exercise 3

Which of the following statements regarding the model of the ideal gas are correct?

a. In the environment of the gaseous body, standard conditions must always be given.
b. Like any model, it is inaccurate.
c. The volume of the gas particles is considered very small, but >0.
d. It also applies to gases that interact chemically with each other.

Exercise 4

An ideal gas is located in a flask. Due to compression, the volume of the flask is reduced by half. What happens?

a. If the pressure is kept constant, then the temperature remains the same, too.
b. The pressure doubles and the temperature reduces by half.
c. The amount of substance remains the same and the general gas constant R has to be multiplied by 2.
d. If the temperature is kept constant, then the pressure doubles.

Exercise 5

There is an ideal gas in a rigid vessel and more gas is pumped in through a vale. What happens?

a. The pressure increases.
b. The volume increases.
c. The temperature decreases.
d. The amount of substance doubles.

Exercise 6

A gaseous body consists of a compound of 1 *mol* of gas A and 1 *mol* of gas B. The particle mass of gas B is twice as high as the particle mass of gas A. If the temperature is doubled, then…

a. … the particles of gas A absorb twice as much energy as the particles of gas B.
b. … the particles of gas B absorb twice as much energy as the particles of gas A.
c. … the particles of both gases absorb the same amount of energy.
d. … the particles of both gases A and B will not absorb any energy.

Core Module	Life Sciences
Exercice 2 – Solutions	

Exercise 1

Solution: C

The volume is predetermined by the rigid vessel and cannot change. The number of particles also remains constant because the vessel is closed. In order for the equation to still be correct when the temperature increases, the pressure in the glass must also increase.

Exercise 2

Solution: A

If an expression in the formula changes in magnitude, the expression on the other side of the equal sign changes by the same amount. Since the pressure is kept constant, the volume must change when the temperature is increased. This is possible in a flexible container.

Exercise 3

Solution: B

The model of the ideal gas describes the behaviour of gas bodies only approximately. It can therefore make statements that do not agree 100% with observations of some gases or some mixtures of gases. It thus leaves room for erroneous statements. This limitation of the model also applies to other scientific models, since they always represent only an attempt to describe reality as accurately as possible.

Exercise 4

Solution: D

The statements A to C do not fit the formula.

If the pressure and temperature remained the same, the amount of substance or the constant *R* would have to change. The amount of substance cannot change in a closed flask. A natural constant does not change either.

If the pressure doubled and the temperature halved, the expressions on both sides of the equals sign would no longer be the same.

A multiplier cannot simply be arbitrarily inserted into the formula. In addition, it does not fit that the expression on the left would be halved, but the expression on the right would be doubled.

If the pressure doubles, the amount of the product on the left side of the equal sign remains the same. If the temperature is kept constant at the same time, the formula is correct. Answer D is therefore correct.

Exercise 5

Solution: A

Since it is a rigid vessel, the volume cannot change. No statement is made about the amount of substance, so the factor by which the amount of substance increases cannot be determined.

It does not make sense that the temperature decreases when more particles move freely in the given volume and collide with each other. That the pressure increases, on the other hand, does. Solution A is therefore correct.

Exercise 6

Solution: C

For gases considered according to the ideal gas law, the following applies: The average energy of the particles of a gas is independent of the type of gas for a given temperature, i.e. it is the same for all gases at one and the same temperature. Due to the constant collision, the energy is distributed evenly among all particles.

It follows that the particles of both gases absorb the same amount of energy. Solution C is correct.

Subject Module	Engineering
Exercise 1	

Buoyancy

Objects in a fluid (e.g. air or water) experience a buoyant force. According to *Archimedes' principle*, the buoyant force is as large as the weight of the fluid that the object displaces. The gravitational acceleration as well as the density and volume of the displaced fluid determine the weight of the displaced fluid. The buoyant force is therefore given by:

$$F_B = \rho_{Fluid} \cdot V_O \cdot g$$

F_B	Amount of buoyant force
ρ_{Fluid}	Density of the fluid
V_O	Volume displaced by the object
g	Gravitational accleration

Gravitational acceleration indicates the acceleration of an object in the gravitational field of the earth. On the earth surface, the gravitational acceleration is approximately constant: $g \approx 10 m/s^2$

When an object is completely immersed in a medium, the following states can be distinguished using the buoyant force:

Sink	$F_B < F_{G,Object}$
Float	$F_B = F_{G,Object}$
Rise	$F_B > F_{G,Object}$

The state $F_B = F_{G,Object}$ can also occur if an object is only incompletely immersed in a medium. Then the object “swims”.

Exercise 1

What is the relationship between the buoyant force, the displaced volume, and the density of the fluid?

a. The weight of the displaced fluid, the volume, and the density of the object determine the direction of the buoyant force.
b. The buoyant force decreases when the displaced volume of the fluid decreases.
c. The buoyant force increases when the density of the object increases.
d. The buoyant force icreases when the displaced volume and density of the fluid increase.

Exercise 2

A can with a sugar-containing drink and a can with a sweetener-containing drink are placed in a tub of water. Both cans have the same volume and are made of the same material. The can of sugary drink sinks. The can with the sweetener-containing drink swims. Which statement regarding the mass of the can content is correct?

a. The mass in the cans is the same.
b. The can with the sweetener-containing drink has a higher mass than the can with the sugar-containing drink.
c. The mass of the can with the sugar-consisting drink is higher than the mass of the can with the sweetener-containing drink.
d. Sinking and swimming are independent of the mass of the cans.

Exercise 3

A wooden boat swims in a bucket of water. A stone figure is put on the boat. The figure falls into the water and sinks to the bottom of the bucket. What happens to the water level?

a. The water level remains the same because the boat and the figure displace the same volume of water as before.
b. The water level decreases because the figure only displaces its own volume.
c. The water level decreases because the boat does not displace volume anymore.
d. The water level increases because the figure displaces more volume.

Exercise 4

Why is buoyancy greater in salt water than in fresh water?

a. The density of salt water is greater than the density of fresh water.
b. The volume of salt water is smaller than the volume of fresh water.
c. The weight force in salt water has a smaller influence on the lifting force.
d. The weight of the object is lower in fresh water.

Exercise 5

A submarine swims in water. The volume of a submarine during surfacing and diving remains the same. For diving, the submarine must release air and be filled with water.

The following applies:

- mass of the submarine m_S= 14.200 t
- volume of the submarine V_S = 24.000 m^3
- Density of water ρ ≈ 1 $\frac{t}{\mathrm{m}^3}$
- Gravitational acceleration g ≈ 10 $\frac{m}{\mathrm{s}^2}$

How much water (with mass m_W) must fill the submarine so that the submarine can dive?

a. 14.200 t
b. 10.000 t
c. 24.000 t
d. 9.800 t

Subject Module **Engineering**

Exercise 1 – Solutions

Exercise 1

Solution: D

The buoyancy force always acts against the acceleration of a body in the earth's gravitational field, its direction is therefore not determined by volume, density and weight force. When looking at displaced volume in isolation, it is not possible to determine whether the buoyancy force is decreasing or increasing. Furthermore, it is not the density of the body that is decisive for the buoyancy force, but the density of the medium.

Exercise 2

Solution: C

The density of the sugary drink seems to be greater than that of the water. Therefore it sinks. Since the sweetened drink floats with the same volume, its density must be lower. Density is defined as the product of volume and weight. Therefore, for the same volume, the sweetened drink has a lower mass.

Exercise 3

Solution: B

Since the density of the stone is higher than that of the wood, the contribution of the figure to the displacement is disproportionate to its volume.

Exercise 4

Solution: A

The density of salt water is higher than the density of fresh water. From the formula it follows that for bodies of equal displaced volume, the buoyancy force is greater in the medium with higher density.

Exercise 5

Solution: B

In order for the submarine to be able to descend, it must have a higher weight than the body of water it displaces when diving. This is not yet the case with an intake of 9,800 tonnes. However, 10,000 t is sufficient; a higher intake is not necessary.

Subject Module	Engineering
Exercise 2	

Synthetic materials

Synthetic materials are divided into thermoplastics, thermosets and elastomers according to their physical properties.

Depending on their composition, **thermoplastics** can already be deformed at room temperature. At temperatures between 80 and 160 degrees, they become soft and can be completely reshaped by various processes. Thermoplastics retain their new shape after they have cooled down. When heated again they become so soft, that their new shape is lost again.

Thermosets are hardened synthetic materials. They remain hard even at higher temperatures. They do not burn or melt and cannot be welded. Above a certain temperature range, they decompose. Their shape can only be changed by machining (comparable to woodworking).

Elastomers can change their shape for a short time by pressure or elongation. After the application of force, they return to their original shape. They are largely insoluble in solvents and do not soften when heated.

In the synthetic production of plastics from so-called *monomers* (reactive molecules), a distinction is made between three types:

Polymerisation: Monomers react by cleavage and reattachment to form bonds of polymers. Pressure and heat turn the multiple bonds of the monomers into single bonds. The single bonds allow the monomers to combine to form polymers (*chain polymerization)*.

Polycondensation: Monomers react to form polymers by splitting off simple molecules (e.g. water).

Polyaddition: Monomers are linked together additively (without splitting off certain molecules as in polycondensation).

Exercise 1

How can you check whether the material is thermoset or thermoplastic?

a. With solvents
b. By heating
c. By application of force (e.g. with a hammer)
d. By cooling

Exercise 2

What process is polymerisation?

a. When the same molecules merge, water is split off.
b. During the exchange of protons, individual molecules combine to form a giant molecule.
c. By adding energy, connections are split and new ones are created.
d. Monomers react by splitting complex molecules into multiple bonds.

Exercise 3

Which everyday object is a thermoplastic?

a. Yoghurt cups
b. Pan
c. Reflectors in car headlights
d. Fire helmet

Exercise 4

Which everyday object is a thermoset?

a. Ballpoint pen
b. Shower curtain
c. Vinyl record
d. Power socket

Exercise 5

Wel Which one of the following statements on the characteristics of synthetic materials is correct?

a. Due to their molecular structure, thermosets can be processed with tools.
b. Thermosets can change their shape by heating and cooling.
c. Thermoplastics are brittle and crack when subjected to force.
d. Thermoplastics do not deform as easily under heat as thermosets.

Subject Module	Engineering
Exercise 2 – Solutions	

Exercise 1

Solution: B

Since thermoplastics can already be deformed at relatively low temperatures, heating is a suitable method to distinguish between thermosets and thermoplastics.

Exercise 2

Solution: C

Answer C is correct. As described in the text, the multiple bonds of the monomers can be broken under pressure and heat, whereupon they link with other monomers to form polymers. The other solutions can also be excluded.

Exercise 3

Solution: A

Since all the other three are applications that require heat resistance, only the yoghurt pot comes into question.

Exercise 4

Solution: D

For a socket, the properties of thermosets are important: they do not burn and they do not melt. The other three items mentioned can melt or burn.

Exercise 5

Solution: A

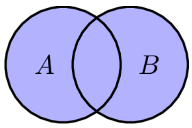
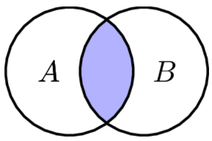
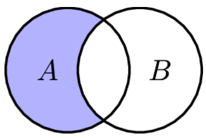
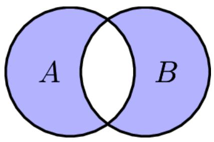
The shape of thermosets can be changed by machining. This machining is comparable to wood processing.

Set Theory

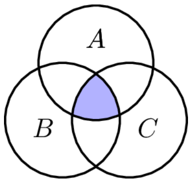
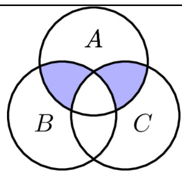
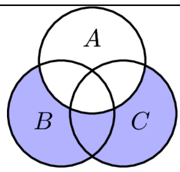
Sets are collections of arbitrary objects. They may contain amongst other things: mathematical objects such as numbers (for example: the set of all integer numbers), objects from daily life, or people (for example: the set of all students). A finite set can be written by listing all its elements between curly brackets. For example:

$A = \{1, 2, 3\}$

is the set A only containing the numbers 1, 2 and 3. For the two sets A and B, there are four basic operations. Each of these operations can be illustrated with the help of a Venn diagram in which the elements of the resulting set are colored:

Symbol	Operation	Definition	Venn-Diagram
$A \cup B$	Union of A and B	All elements that belong to A or B	
$A \cap B$	Intersection of A and B	All elements that belong to both A and B	
$A \setminus B$	Difference of B relative to A	All elements that belong to A but not to B	
$A \triangle B$	Symmetric difference of B and A	All elements that are only in A or only in B	

Operations involving three sets *A*, *B,* and *C* also can be visualized by a Venn diagram. The following table shows three examples:

Operation	Venn-Diagramm
$A \cap B \cap C$	
$(B \bigtriangleup C) \cap A$	
$(B \cup C) \setminus A$	

Exercise 1

Let $A = \{1, 2, 3\}$ and $B = \{2, 4, 1\}$. Which of the following statements is correct?

a. $A \cap B = \{2\}$
b. $A \cap B = \{1, 2\}$
c. $A \cap B = \{3, 4\}$
d. $A \cap B = \{1, 2, 3, 4\}$

Exercise 2

Let $A = \{1, 2, 3\}$ and $B = \{2, 4, 1\}$. Which of the following statements is correct?

a. $A \cup B = \{2\}$
b. $A \cup B = \{1, 2\}$
c. $A \cup B = \{3, 4\}$
d. $A \cup B = \{1, 2, 3, 4\}$

Exercise 3

Let $A = \{1, 2, 3\}$ and $B = \{2, 4, 1\}$. Which of the following statements is correct?

a. $A \bigtriangleup B = \{2\}$
b. $A \bigtriangleup B = \{1, 2\}$
c. $A \bigtriangleup B = \{3, 4\}$
d. $A \bigtriangleup B = \{1, 2, 3, 4\}$

Exercise 4

Which of the following statements holds for all sets A and B?

a. The set $A \cap B$ contains all elements from B.
b. The set $A \cap B$ contains no elements from B.
c. The set $A \cap B$ only contains one element from B.
d. The set $A \cap B$ only contains elements of B that are also in A.

Exercise 5

Which of the following statements holds for all sets A and B?

a. The set $A \cup B$ contains all elements from B.
b. The set $A \cup B$ contains no elements from B.
c. The set $A \cup B$ only contains elements from B.
d. The set $A \cup B$ only contains elements of B that are also in A.

Exercise 6

Which of the following statements holds for all sets A and B?

a. The set $A \setminus B$ contains all elements from B.
b. The set $A \setminus B$ contains no elements from B.
c. The set $A \setminus B$ only contains elements from B.
d. The set $A \setminus B$ only contains elements of B that are also in A.

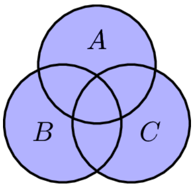
Exercise 7

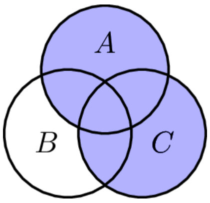
Which of the following statements is <u>not</u> correct?

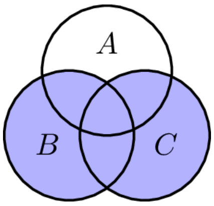
a. $A \cap B = B \cap A$
b. $A \cup B = B \cup A$
c. $A \setminus B = B \setminus A$
d. $A \triangle B = B \triangle A$

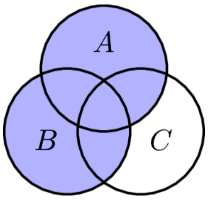
Exercise 8

Which of the following Venn diagrams visualizes $A \cup B \cup C$?

a. 

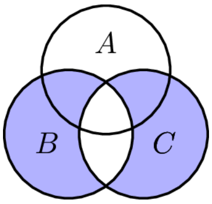
b. 

c. 

d. 

Exercise 9

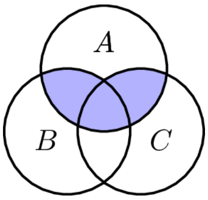
Which operation is presented by the following Venn diagram?



a. $A \triangle B$
b. $B \triangle C$
c. $C \triangle A$
d. $A \triangle B \triangle C$

Exercise 10

Which operation is presented by the following Venn diagram?



a. $(B \cup C) \cap A$
b. $(B \cap C) \cup A$
c. $(B \cup A) \cap C$
d. $(B \cap A) \cup C$

Exercise 11

Which of the following statements is <u>not</u> correct?

a. $A \triangle B = (A \cup B) \setminus (A \cap B)$
b. $A \triangle B = (A \setminus B) \cup (B \setminus A)$
c. $A \triangle B = (A \setminus B) \cap (B \setminus A)$
d. $A \triangle B = ((A \cup B) \setminus B) \cup ((B \cup A) \setminus A)$

Subject Module **Mathematics, Computer Science, Natural Sciences**

Exercise 1 – Solutions

Exercise 1

Solution: B

The symbol ∩ stands for the intersection of both sets, i.e., all elements that belong to both sets. These are here 1 and 2.

Exercise 2

Solution: D

The symbol ∪ stands for the union of both sets. Only in answer D all numbers of both sets are given.

Exercise 3

Solution: C

The symbol △ stands for the symmetric difference. $A \triangle B$ means all elements which are only in A or only in B. This is true for 3 and 4.

Exercise 4

Solution: D

The statement under answer D describes in other words the explanation from table in the task.

Exercise 5

Solution: A

The expression $A \cup B$ describes the union of both sets, it contains all elements from both sets, thus also all elements from B. The other statements can therefore not be true.

Exercise 6

Solution: B

The expression $A \setminus B$ means: All elements that belong to A but not to B. So, the set does not contain any elements from B.

Exercise 7

Solution: C

If we determine the quantities meant in the 4 statements on both sides of the equal sign, it turns out that all statements are equal quantities, except for answer C.

Exercise 8

Solution: A

All sets are connected by $\cup$. The Venn-Diagram in answer A represents this. All elements of all subsets are included.

Exercise 9

Solution: B

By the illustration it becomes clear that it must be symmetrical difference. Since in set A the largest part is not colored, but only the parts that also belong to sets B and C, set A does not have to be considered. $B \triangle C$ fits the Venn-Diagram that was linked to $A \triangle B$ in the task text.

Exercise 10

Solution: A

$(B \cap C) \cup A$ means the following set: All elements contained in B and C plus all elements from set A. The circle A should therefore be completely colored. This expression can therefore not be correct.

$(B \cup A) \cap C$ means the following set: All elements from the groups B and C that are also contained in set C. The intersection of circles B and C would therefore have to be completely filled with color. This expression can therefore not be correct.

$(B \cap A) \cup C$ means the following set: All elements contained in B and A plus all elements from set C. The circle C should therefore be completely colored. This expression can therefore not be correct.

The expression $(B \cup C) \cap A$ fits. It means all the elements from sets B and C that are additionally contained in set A. This agrees with the Venn-Diagram.

Exercise 11

Solution: C

$A \triangle B$ means all elements which are only in A or only in B.

$(A \cup B) \setminus (A \cap B)$ means all elements from A and B without the elements that are contained in both sets, i.e., all elements that are only in A or only in B.

$(A \setminus B) \cup (B \setminus A)$ means all elements from A which are not also contained in B and all elements from B which are not also contained in A. These are all elements which are only in A or only in B.

$((A \cup B) \setminus B) \cup ((B \cup A) \setminus A)$ means all elements from the sets A and B without the elements from B and, conversely, all elements from the sets B and A without the elements from A. These are all elements that are only in A or only in B.

The set $(A \setminus B) \cap (B \setminus A)$ is empty. $\cap$ means the intersection of both expressions left and right of the symbol. However, all possible elements that could be shared are excluded beforehand from the two sets from which this intersection is to result. Therefore, this expression cannot be equated with the expression $A \triangle B$.

Subject Module **Mathematics, Computer Science, Natural Sciences**

Exercise 2

Datatypes

In programming languages, *variables* are names given to memory locations in which you can store values. Most programming languages use typed variables, i.e. each variable has one of several possible data types. In the Java language, for example, the following data types exist (extract):

- **boolean** – Values **false** und **true**, memory requirement of 1 bit
- **short** – integer numbers from -2^{15} bis 2^{15}-1, memory requirement of 16 bit
- **int** – integer numbers from -2^{31} bis 2^{31}-1, memory requirement of 32 bit
- **float** – fractional so-called floating-point numbers up to maximum of approximately $\pm 10^{38}$, memory requirement of 32 bit
- **double** – floating-point numbers up to max. approx. $\pm 10^{308}$, memory requirement of 64 bit
- **string** – character string, sequence of characters of any length, memory requirement depends on length

In a Java program, a variable can be defined by indicating the type and the name of the variable. A location in memory is then reserved. If a value is also specified, this memory is initialized with this value, e.g.:

```
int x = 5;
string s = "Hello 😊";
```

These two examples show how integer constants and strings are written. Floating-point numbers consist of digits with a decimal point and/or an exponent, which has a similar meaning as the exponent representation on the calculator:

```
float f1 = 5.0;
float f2 = +5e0;
float f3 = +50e-1;
float f4 = 5.00000e0;
float f5 = 5f;
```

Alternatively, a small "f" can be appended to a number to indicate the type **float** (small d for type **double**). So all of these five variables have the same floating-point type value of 5.

Calculations are performed in Java only in **int** and **double**. This means that there is an implicit type conversion to one of these types, e.g., **short** to **int** and **float** to **double**, when any calculation is performed. If two operands are of different types, then their types are unified, i.e., **int** becomes **double**. An implicit type conversion also takes place during an assignment.

```
float f6 = 5;
float f7 = 2 * 2.5;
```

At **f6**, the type **int** is implicitly converted to the type **float**. In **f7** we have a multiplication of an **int** and a **double** value. The **int** value is first converted to **double** and then multiplied. The result is then implicitly converted to **float**.

Calculations in type **int** usually return an int result, i.e., the division is also only integer and ignores the fractional part.

Exercise 1

You have a variable "married" that should store whether a person is married, a variable "age" that gives the age of a person, and a variable "name" that contains the name of the person. Which of the following types are most appropriate?

a. **boolean married**; **float age**; **string name**;
b. **int married**; **float age**; **string name**;
c. **boolean married**; **short age**; **string name**;
d. **short married**; **short age**; **double name**;

Exercise 2

Two values from two **float** variables are added. The calculation is done in which type?

a. **boolean**
b. **float**
c. **int**
d. **double**

Exercise 3

Two values from two short variables are divided. The calculation is done in which type?

a. **float**
b. **int**
c. **double**
d. **short**

Exercise 4

The following Java program is given:

```
short s = 4;
float x = 3 + s/3;
```

What is the value of the variable **x** after its assignment?

a. 4,33333333333sd
b. 4
c. 3
d. 4,25

Exercise 5

You need 1000 **float** variables. How much memory do they require?

a. 16000 Bit = 2000 Byte
b. 1000 Bit = 125 Byte
c. 32000 Bit = 4000 Byte
d. 32768 Bit = 4096 Byte

Exercise 6

The following Java program is given:

```
int i = 2;
double d = (-i)*(1/i)+1f;
```

What is the value of the variable **d** after its assignment?

a. -1
b. 0
c. 2
d. 1

Subject Module **Mathematics, Computer Science, Natural Sciences**

Exercise 2 – Solutions

Exercise 1

Solution: C

The most efficient storage you get with answer C. For the variable "married" it is enough to store *true* or *false*. For the "name", the file type *string* is best. The "age" is usually stored in integer numbers. The file type *short* is therefore the most efficient way to store the age.

Exercise 2

Solution: D

In Java, calculations are performed only in *int* or *double*. Since two *float* variables are added, they are converted to *double*.

Exercise 3

Solution B:

In Java, calculations are performed only in *int* or *double*. Since two *short* variables are divided, they are converted to *int*.

Exercise 4

Solution: B

The calculation with the *short* variable s = 3 is implicitly converted to *int*. Only integer numbers can be stored via *int*. Therefore, a 1 is stored for s/3. Adding to x = 3 results in 4.

Exercise 5

Solution: C

The memory requirement of a *float* variable is 32 bits. 1000 variables therefore require 32000 bits. 8 bits are 1 byte.

Exercise 6

Solution: D

The expression in the second parenthesis stands for a fraction or a decimal number. However, since only integer numbers can be stored in an int variable, only the first part of the number is stored, i.e. 0. The product therefore also becomes 0. If a 1 (1f) is then added, the result is 1.

Subject Module	Economics
Exercise 1	

Marketing: Marketing-Mix

The marketing mix describes the best possible combination of marketing instruments to position a company or product on the market as well as possible. The marketing mix consists of four areas: (i) Product, (ii) Price, (iii) Promotion and (iv) Place. They are called the four Ps.

Product covers decisions that affect the product. This includes, for example, determining the characteristics and quality of the products, the composition of assortments or customer service. Pricing-setting is the main concern of the Price category. In addition to price setting, other marketing decisions regarding the price (e.g., giving discounts, payment terms) must also be taken into account. Promotion deals with decisions of how to communicate with potential buyers. This includes advertising, public relations including image cultivation and building a good reputation. Place defines the distribution channel by which the products or services are sold to the customer. A fundamental decision in this regard is, whether the products are distributed directly or indirectly (that is, via a retailer).

Exercise 1

Which area is <u>not</u> part of the marketing mix?

a. Press
b. Product
c. Price
d. Place

Exercise 2

A publisher is considering whether to sell its magazine via the Internet in addition to distribution by commercial enterprises. Which area of the marketing mix does this refer to?

a. Price
b. Product
c. Place
d. Promotion

Exercise 3

A car manufacturer supports a sporting event via sponsoring. Which area of the marketing mix does this refer to?

a. Price
b. Product
c. Promotion
d. Place

Exercise 4

A fashion company offers a discount of 5% for purchases over 75€. Which area of the marketing mix does this refer to?

a. Produce
b. Price
c. Place
d. Promotion

Exercise 5

Which marketing strategy is an example for the product category?

a. A television can be paid for in monthly instalments.
b. You can try a granola bar for free at the supermarket.
c. The package size of a spread is increased.
d. A company organises an open day.

Subject Module **Economics**

Exercise 1 – Solutions

Exercise 1

Solution: A

The marketing mix consists of the four Ps: (i) Product, (ii) Price, (iii) Promotion, and (iv) Place. "Press" is therefore not part of the marketing mix.

Exercise 2

Solution: C

Whether a magazine should be sold via the Internet in addition to being sold by retail companies is a decision about the product's distribution channel. This is the subject of distribution policy.

Exercise 3

Solution: C

By supporting a sports event, the car manufacturer promotes its image and builds up a good reputation (public relations). In addition, the event is an opportunity to place advertising. Promotion deals with these issues.

Exercise 4

Solution: B

Giving discounts is a price policy measure. This is the subject of price policy.

Exercise 5

Solution: C

Product policy deals, among other things, with the definition of product characteristics. This also includes deciding on the packaging of products.

Letting customers try a granola bar free of charge or organizing an open day are topics dealt with by promotion policy. The option of paying for a television in instalments is a topic covered by pricing policy.

Subject Module	Economics
Exercise 2	

Macroeconomics: Gross Domestic Product (GDP)

The *gross domestic product (GDP)* is one of the most important indicators of an economy's economic activity. It measures the sum of the market value of the total value generated in a country in a period of time (usually during one year). The GDP calculation includes the final products (i.e., goods and services) that are produced and traded on the market. These final products are, however, not used for the production of other goods or services in the same period of time. Intermediate goods and services are deducted from the GDP to avoid double counting.

The goods included in the GDP can be divided into four categories according to their use:

- *Consumption C*: consumption of goods and services by private households
- *Investments I:* expenditures for goods that will be used for the production of new goods and services in the future (e.g., inventories of goods, machines, buildings) but also inventory adjustments to compensate for the quantity of goods that are in demand and available in a short term
- *Governmental expenses G:* Federal, state or local expenses for infrastructure, goods, and services
- *External Contributions Ex-Im:* exports *Ex* (goods produced in the country and sold abroad) minus imports *Im* (goods produced abroad and used in the country)

Thus, the GDP corresponds to the value of overall economic demand. This is illustrated by the following formula: GDP = C + I + G + Ex – Im.

Additionally, a distinction is made between real and nominal GDP in order to differentiate volume changes from price effects over time. The nominal GDP is calculated with actual prices of the year. The real GDP is calculated with the prices of a previously defined base year. Thereby, it is possible to separate changes of quantities and prices. In fact, GDP can increase by either increasing the number of end products (a real increase of domestic product) or the end products prices (inflation). The ratio of nominal GDP divided by real GDP is called the GDP deflator.

Exercise 1

Which of the following points is not directly reflected in the gross domestic product of country A?

a. The popularity of cars produced in country A increases abroad. In country B there is now a higher demand for cars from country A.
b. A domestic company sells goods from its stock.
c. The value-added tax is increased in country A. The additional resources are used to build a modern telecommunication network.
d. A food producer from country B is expanding his domestic production facilities to sell more in country B.

Exercise 2

The car company Maier buys tires from the company Rubber for 1.5 million € as well as electrical components from the company Jeuter for 500,000 €. All of the tires and electrical components are used for producing the cars. Company Maier sells cars for 10 million € to the end consumer.

What is the contribution of car company Maier to the creation of GDP?

a. 6 million €
b. 8 million €
c. 4 million €
d. 10 million €

Exercise 3

In 2017 and 2018, an economy exclusively produces the goods given in the table.

Fill in the missing gaps in the text.

The nominal GDP was ___**A**___ € for 2017. The real GDP for 2018 (with base year 2017) was ___**B**___ €. . The GDP deflator for 2018 is ___**C**___.

Price in € pro kg			
	Äpfel	Birnen	Benzin
2017	1.0	3.0	6.0
2018	1.0	4.0	8.0

Amount in kg			
	Äpfel	Birnen	Benzin
2017	200	100	50
2018	300	200	50

a. A = 800 €; B = 1,200 €; C = 1.25
b. A = 800 €; B = 1,200 €; C = 0.67
c. A = 1,200 €; B = 1,500 €; C = 1.25
d. A = 800 €; B = 680 €; C = 0.67

Exercise 4

What is the impact of the following situations A and B on the GDP?

A: Lisa buys food at a market for €20 which she prepares at home.

B: A restaurant buys food at a market for €20, prepares it, and sells it to Lisa for €50.

a. A: The GDP increases by €20. B: The GDP increases by €70.
b. A: The GDP remains unchanged. B: The GDP increases by €50.
c. A: The GDP increases by €20. B: The GDP increases by €20.
d. A: The GDP increases by €20. B: The GDP increases by €50.

Exercise 5

Which of the following statements about the GDP deflator is always correct?

a. The size of the GDP deflator reflects both the change in prices of the final products and the change in their quantities.
b. If the GDP deflator decreases, the real GDP will also decrease.
c. If the prices of the end products continue to increase compared to the base year, the GDP deflator will also increase.
d. If the nominal GDP and the GDP deflator increase strongly at the same time, the real GDP will also increase.

Exercise 6

Niklas occasionally helps out as a babysitter for the neighbor's five-year-old child. He does not want to get paid for this. Through which component of the use calculation does Niklas' service enter the GDP?

a. Through none of the components because the service is not sold at the market
b. Through consumption *C*, because it is a voluntary service
c. Through investment *I*, because childcare is an investment in the child's future
d. Through government spending *G*, because Niklas takes on a public task

Exercise 7

In a large city, there is construction work on one of the main roads. This causes long traffic jams during rush hours for one year. During this time, commuters are stuck in traffic jams every day for an additional hour on average. Commuters complain that they need to refuel more often and also have less free time. Which effect does this situation cause on the country's GDP?

a. The GDP remains unchanged because the commuters continue to do their jobs.
b. The GDP decreases because time spent in traffic jams is unproductive.
c. The GDP decreases because the commuters‘ well-being is reduced.
d. The GDP increases because the economic activity increases at gas stations.

Exercise 8

For the year 2017, the Federal Statistical Office documented the following data on the German GDP (nominal, in billion €):

GDP	**3,263**
Private consumer spendings	1,733
Gross fixed capital formation including inventory changes	646
Government expenditure	638
Exports	1,542
Imports	1,294

Which of the following statements is correct?

a. The external contribution was negative.
b. Nearly half of all goods produced in Germany were sold abroad.
c. Only a small part of the GDP was consumed.
d. Governmental expenditure was lower than the external contributions.

Subject Module | Economics

Exercise 2 – Solutions

Exercise 1

Solution: D

Activities of a food producer in country B that relate to the market in country B have no impact on GDP in country A.

Exercise 2

Solution: B

The cost of tires and electrical parts must be deducted from the total price of the cars sold. These added values are not a contribution of the car company Maier to the GDP, but of the companies Gummi and Jeuter. Answer B is therefore the correct solution.

Exercise 3

Solution: A

The nominal GDP for 2017 was €800 (multiply prices and quantities for all three product groups in 2017 and then add them up). The real GDP for 2018 with the base year 2017 was €1200 (prices for 2017 multiplied by the quantities for 2018 for all three product groups and then added). Since the nominal GDP in 2018 was €1500 (procedure as above only with the figures for 2018), the ratio between nominal and real GDP is 1.25 (1500 : 1200 = 1.25). Solution A is therefore correct.

Exercise 4

Solution: D

If Lisa buys food at the market and then consumes it at home, products worth €20 enter GDP.

If the restaurant buys food for €20, which it can sell for 50 € after processing, an additional €30 goes into GDP, for a total of €50.

Exercise 5

Solution: C

Statements A, B and D can be excluded:

Real and nominal GDP are calculated on the basis of the same quantity. The deflator can therefore say nothing about a change in quantities.

If the GDP deflator decreases, this means that nominal GDP becomes smaller compared to real GDP and not vice versa.

The GDP deflator rises sharply if nominal GDP increases more than real GDP. If both were to increase at the same rate, the GDP deflator would remain the same.

GDP deflator is intended to indicate the extent to which an increase in nominal GDP is due to an increase in prices. Statement C expresses this relationship in other words.

Exercise 6

Solution: A

Answer A is correct. Since Niklas does not get paid for his babysitting services, his services are not included in GDP.

Exercise 7

Solution: D

Answer D is correct. Assuming that commuters would not have contributed to alternative value creation (such as through some form of consumption, and there is no info about this in the text) in their lost leisure time, GDP increases because economic activity increases at gas stations.

Exercise 8

Solution: B

Statements A, C and D can be excluded:

Net exports as the difference between exports and imports were not negative, but positive.

The largest share of GDP was generated by consumption by private households.

Government spending of €638 billion was higher than net exports (€1542 - 1294 = €248 billion).

Exports of €1,542 billion are about half of €3,263 billion. Answer B is therefore correct.

Subject Module	Medicine
Exercise 1	

Anatomy: Multiple pregnancy

In vitro fertilisation is becoming more common. This leads to more multiple pregnancies. The probability of a multiple pregnancy is estimated with Hellin's rule (twins 1:80, triplets 1:80²).

Sometimes, two eggs are released during a menstrual cycle. When both eggs are fertilised by sperm, fraternal twins are the result. Each embryo has its own placenta and its own amniotic membrane. The amniotic membrane covers the embryo and is filled with amniotic fluid. During pregnancy, it is possible for the two placentas to merge and to appear as one. Therefore, a shared placenta in an ultrasound check up is no proof for identical twins.

Identical twins result when a single fertilised egg splits into two eggs. The exact date of separation determines whether the identical twins have their own placenta and amniotic sac or whether they share them. There are three types of identical twins, shown in table 1:

	Description	**Date of separation**
dichorionic-diamniotic	each has its own placenta and own amniotic sac	during the first three days after conception
monochorionic-diamniotic	the identical twins share a placenta but have separated amniotic sacs	separation between day 3 and day 8 after conception
monochorionic-monoamniotic	the identical twins share a placenta and an amniotic sac	separation between day 8 and day 13 after conception

Table 1. Types of identical twins.

Exercise 1

What is the probability of having quadruplets?

a. $1{:}80^2$
b. $1{:}80^4$
c. $1{:}80^5$
d. $1{:}80^3$

Exercise 2

During a medical ultrasound, a gynaecologist sees a male and a female embryo. Which type of chorionicity and amniosity exists at the very beginning of pregnancy?

a. A clear statement is not possible.
b. Monochorionic-diamniotic
c. Monochorionic-monoamniotic
d. Dichorionic-diamniotic

Exercise 3

A woman visits her gynaecologist because her pregnancy test was positive. During the medical ultrasound, the gynaecologist sees two embryos but only one placenta. Which statement about the twins is correct?

a. They are fraternal twins.
b. They are identical twins.
c. A clear statement is not possible.
d. The fertilised egg separated during day 8 and day 13.

Exercise 4

To be sure that a woman is pregnant with identical twins, which type of chorionicity and amniosity must be determined in an ultrasound?

a. Monochorionic-monoamniotic
b. Dichorionic-diamniotic
c. Monochorionic-diamniotic
d. It is not possible to determine this without a genetic analysis.

Exercise 5

The feto-fetal transfusion syndrome (FFTS) is a complication in which placentary blood vessels between twins interconnect. Therefore, blood transfer can be unbalanced from one twin (the "donor") to the other (the "recipient"). Which statement is correct?

a. The donor twin has too much blood and the recipient twin has not enough blood.
b. The FFTS occurs especially in monochorionic types.
c. The FFTS occurs especially in fraternal twins.
d. The FFTS occurs if the egg splits during the first three days after conception.

Exercise 6

If the fertilised egg splits after day 14 (after conception), conjoined twins may occur. They are classified by the point at which their bodies are joined. Which statement about Siamese twins is correct?

a. They occur with a probability of 1:80.
b. They share a placenta and an amniotic sac.
c. They only occur if one egg is fertilised by two sperms.
d. They are monochorionic-diamniotic.

Subject Module	Medicine
Übungsaufgabe 1 – Lösungen	

Exercise 1

Solution: D

The probability of another fertilization can be calculated by multiplying the probabilities. Therefore, the result is $1{:}80^2$ * $1{:}80$ = $1{:}80^3$.

Exercise 2

Solution: D

Since the two embryos are of different sexes, they cannot be identical twins. Therefore, at the beginning of the pregnancy they must have been dichorial-diamniot.

Exercise 3

Solution: C

When only one placenta can be observed, the number of amniotic sacs is crucial to distinguish between identical and fraternal twins.

Exercise 4

Solution: A

Only if a monochorial-monoamniotic condition can be established without doubt, it can be said with certainty that the twins are identical.

Exercise 5

Solution: B

Statement B is correct. The embryos must share a placenta for the syndrome to occur. Therefore, solutions C and D can also be excluded, since in both cases there is no monochorionicity.

The question states that the blood transfer may be unbalanced. This includes the possibility that the "donating" embryo secondarily does not have enough blood. Answer A can therefore also be excluded.

Exercise 6

Solution: B

Only the solutions B and D are possible. The other two solutions contradict the task text. Since the embryos remain connected after division, it cannot be that they have two different amniotic sacs. Answer D can therefore also be excluded.

Fachmodul	Medizin
Exercise 2	

Physiology: Blood type

The AB0 system and the Rhesus system are well-known systems for classification of blood types. In the AB0 system, the considered antigens are located on the surface of red blood cells. Each person has two antigenic traits, with only one being passed on to the next generation. A baby's blood group is thus determined by the inherited trait of the mother and the inherited trait of the father. The traits A and B are equivalent to each other. Both are dominant to the antigen 0.

Blood plasma is the liquid component of blood. It contains antibodies against the missing antigen. A person with blood type A therefore has antibodies against B in their plasma. Persons with blood type 0 have no antigens on the surface of red blood cells, but antibodies against A and B in their blood plasma.

It is important to determine the blood type before a blood transfusion. Otherwise, a person's antibodies can cause the red blood cells of the foreign blood groups to clump together.

The Rhesus system is based on different antigens, such as C, D, E, c, d and e. Antigen D has the strongest antigenic effect. A person with DD or Dd is Rh-positive. Rh-negative is indicated by dd. D is dominant over d. In contrast to the AB0 system, there are no automatically generated antibodies. Antibodies arise only in case of improper transfusions or during pregnancy or birth. Only Rh-negative persons can form antibodies after contact with Rh-positive blood. Therefore, a Rh-negative mother can produce antibodies if she is pregnant with a Rh-positive child. During a new pregnancy with a Rh-positive child, the antibodies enter the child's blood and destroy their red blood cells.

Exercise 1

How many blood types are possible in the AB0 system?

a. 3 blood types
b. 4 blood types
c. 2 blood types
d. 5 blood types

Exercise 2

Which statement about the AB0 system is correct?

a. Persons with blood type B have antibodies against the A-antigen.
b. Persons with blood type A have antibodies against the A-antigen.
c. Persons with blood type 0 have no antibodies against the A-and B-antigen.
d. Persons with blood type AB have antibodies against the A-and B-antigen.

Exercise 3

An injured patient with blood type A needs red blood cells. Which blood types can be transfused?

a. Only 0
b. Only A
c. A and 0
d. A, B and AB

Exercise 4

A patient with blood type 0 needs plasma. From whom can she receive blood plasma?

a. A and B
b. Only 0
c. AB, A, B and 0
d. AB

Exercise 5

In which blood type of mother and father is a re-pregnancy (e.g., second pregnancy) a risk for the unborn child, if the mother has not received Rhesus prophylaxis at the first pregnancy?

a. Mother: A, Rh-positive, Father: 0 Rh-positive
b. Mother: 0, Rh-negative; Father: A Rh-negative
c. Mother: A, Rh-positive, Father: B Rh-negative
d. Mother: B, Rh-negative; Father: 0 Rh-positive

Exercise 6

A woman with blood type 0 (Rh-negative) gives birth to dizygotic twins. One newborn has blood group B (Rh-negative) the other has blood group A (Rh-positive). Which blood type does the father have?

a. AB, Rh-negative
b. AB, Rh-positive
c. 0, Rh-positive
d. The blood groups were not determined correctly.

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Fachmodul	Medizin
Exercise 2 – Lösungen	

Exercise 1

Solution: B

In the AB0 system, there are four blood groups: AB, A, B and 0.

Exercise 2

Solution: A

Only statement A is correct. The other answers contradict the information in the task text.

Exercise 3

Solution: C

Since group 0 blood contains no antigens, it can be transfused to a person with blood group A, just like their own blood group. In the question, the rhesus factor is not included for simplicity.

Exercise 4

Solution: C

Since the blood cells of persons with blood group 0 have no antigens on their surface, they are universal recipients for blood plasma of all blood groups.

Exercise 5

Solution: D

From the task text: „Only Rh-negative persons can form antibodies after contact with Rh-positive blood. Therefore, a Rh-negative mother can produce antibodies if she is pregnant with a Rh-positive child. During a new pregnancy with a Rh-positive child, the antibodies enter the child's blood and destroy their red blood cells."

Only if the father has a Rh-positive blood type can the child also become Rh-positive, causing the mother to produce antibodies.

Exercise 6

Solution: B

In the case of blood group AB, the father can pass on the antigens A or B to his children. If the Rh factor is positive, the children can inherit either the Rh-negative trait from the mother or Rh-positive from the father. Thus, in this constellation, the observed blood groups of both children are possible. This is not the case with the other proposed blood groups of the father.

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