

# Toetsmatrijs PPL Meteorology + Operational procedures



In deze toetsmatrijs staat wat u moet kunnen en kennen. De toetsmatrijs vormt daarom de basis van de opleiding en het examen.

<b>Opgesteld door:</b>	<b>CBR divisie CCV</b>
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Categoriecode:	LVPAMET (PPLA, LAPLA) en LVPHMET (PPLH, LAPLH)
Toetsvorm:	Digitaal
Totaal aantal vragen:	20 meerkeuzevragen
Cesuur:	75% (15 van de 20 vragen goed)
Bijzonderheden:	Geen

Nr	Eindtermen
<b>050 00 00 00</b>	<b>METEOROLOGY</b>
050 01 00 00	The atmosphere
050 02 00 00	Wind
050 03 00 00	Thermodynamics
050 04 00 00	Clouds and fog
050 05 00 00	Precipitation
050 06 00 00	Air masses and fronts
050 07 00 00	Pressure systems
050 08 00 00	Climatology
050 09 00 00	Flight hazards
050 10 00 00	Meteorological information
<b>070 00 00 00</b>	<b>OPERATIONAL PROCEDURES</b>
071 02 00 00	Special operational procedures and hazards (general aspects) → <b>Alleen 071 02 07 00 Wind shear and microburst</b>

<b>Vastgesteld door:</b>	Technische Commissie Meteorology + Operational procedures
<b>Beoordeeld door:</b>	Logistiek, Transport en Personenvervoer raad; kamer 3: Luchtvaart <14 september 2018>
<b>Goedgekeurd door:</b>	Divisiemanager CCV <17 september 2018>
<b>Ingangsdatum:</b>	<1 april 2019>

## Toelichting

Eindtermen: Dit zijn de hoofdonderwerpen die in het examen voorkomen. Hierin staat 'ruim' omschreven wat er in het examen terug kan komen.

Toetstermen: Dit zijn onderdelen van een eindterm. Hierin staat meer uitgebreid omschreven wat er in het examen terug kan komen.

Tax: Dit is de taxonomiecode van Romiszowski. Deze code geeft aan op welk niveau de vragen over een toetsterm gesteld worden.

F = Feitelijke kennis. De kandidaat kan feiten reproduceren (herkennen of herinneren).

B = Begripsmatige kennis. De kandidaat kan begrippen of principes omschrijven.

R = Reproductieve vaardigheden. De kandidaat kan acties uitvoeren die volgens een vastgelegde procedure verlopen.

P = Productieve vaardigheden. De kandidaat kan acties uitvoeren waarbij hij zijn eigen creativiteit en inzicht nodig heeft.

Eind- en toetstermen		Tax	PPLA	PPLH
050 00 00 00	<b>METEOROLOGY</b>			
050 01 00 00	<b>The atmosphere</b>			
050 01 01 00	<b>Composition, extent, vertical division</b>			
050 01 01 01	<b>Structure of the atmosphere</b>			
(01)	Describe the vertical division of the atmosphere, based on the temperature variations with height.	B	X	X
(02)	List the following layers and their main qualitative characteristics: - troposphere; - stratosphere (lowest part only).	F	X	X
050 01 01 02	<b>Troposphere</b>			
(01)	Describe the troposphere.	B	X	X
(02)	Describe the main characteristics of the tropopause.	B	X	X
(03)	Describe the proportions of the most important gases in the air in the troposphere.	B	X	X
050 01 02 00	<b>Air temperature</b>			
050 01 02 01	<b>Definition and units</b>			
(01)	Define 'air temperature'.	F	X	X
(02)	List the units of measurement of air temperature used in aviation meteorology (°C, °F).	F	X	X
050 01 02 02	<b>Vertical distribution of temperature</b>			
(01)	Describe the mean vertical distribution of temperature in the troposphere.	B	X	X
(02)	Mention the general causes of the cooling of the air in the troposphere with increasing altitude.	F	X	X
(03)	Calculate the temperature and temperature deviations (in relation to International Standard Atmosphere (ISA)) at specified levels.	R	X	X
050 01 02 03	<b>Transfer of heat</b>			
(01)	Explain how local cooling or warming processes result in transfer of heat.	B	X	X
(04)	Describe the filtering effect of the atmosphere on solar radiation.	B	X	X
(06)	Explain how terrestrial radiation is absorbed by some components of the atmosphere.	B	X	X

Eind- en toetstermen		Tax	PPLA	PPLH
(07)	Explain the effect of absorption and radiation in connection with clouds.	B	X	X
(10)	Explain the process of convection.	B	X	X
(11)	Name the situations in which convection occurs.	F	X	X
(12)	Explain the process of advection.	B	X	X
<b>050 01 02 04</b>	<b>Lapse rates</b>			
(01)	Describe qualitatively and quantitatively the temperature lapse rates of the troposphere (mean value 0.65°C/100 m or 2°C/1000 ft and actual values).	B	X	X
<b>050 01 02 05</b>	<b>Development of inversions, types of inversions</b>			
(01)	Describe the development and types of inversions.	B	X	X
(02)	Explain the characteristics of inversions and of an isothermal layer concerning stability and vertical motions.	B	X	X
(03)	Explain the reasons for the formation of the following inversions: - ground inversion (nocturnal radiation / advection), subsidence inversion, frontal inversion, inversion above friction layer.	B	X	X
<b>050 01 02 06</b>	<b>Temperature near the Earth's surface, surface effects, diurnal-variation, effect of clouds, effect of wind</b>			
(01)	Explain the cooling/warming of the surface of the Earth by radiation.	B	X	X
(02)	Explain the cooling/warming of the air by heat transfer to/from the earth or sea surfaces.	B	X	X
(p01)	Sketch the diurnal variation of the temperature of the air in relation to the radiation of the sun and of the Earth.	R	X	X
(03)	Describe qualitatively the influence of the clouds on the cooling and warming of the surface and the air near the surface.	B	X	X
(04)	Explain the influence of the wind on the cooling and warming of the air near the surfaces.	B	X	X
<b>050 01 03 00</b>	<b>Atmospheric pressure</b>			
<b>050 01 03 01</b>	<b>Barometric pressure, isobars</b>			
(01)	Define 'atmospheric pressure'.	F	X	X
(02)	List the units of measurement of the atmospheric pressure used in aviation (hPa, inches of Mercury).	F	X	X
(04)	Define isobars and identify them on the surface weather charts.	F	X	X
(05)	Define 'high', 'low', 'trough', 'ridge', 'col'.	F	X	X
<b>050 01 03 02</b>	<b>Pressure variation with height</b>			
(01)	Explain the pressure variation with height.	B	X	X

Eind- en toetstermen		Tax	PPLA	PPLH
(02)	Describe quantitatively the variation of the barometric lapse rate. <i>Note: An approximation of the barometric lapse rate near mean sea level is 27 ft (8 m) per 1 hPa.</i>	B	X	X
<b>050 01 03 03</b>	<b>Reduction of pressure to QFF (MSL)</b>			
(01)	Define 'QFF'.	F	X	X
(03)	Mention the use of QFF for surface weather charts.	B	X	X
<b>050 01 04 00</b>	<b>Air density</b>			
<b>050 01 04 01</b>	<b>Relationship between pressure, temperature and density</b>			
(01)	Describe the relationship between pressure, temperature and density.	B	X	X
(02)	Describe the vertical variation of the air density in the atmosphere.	B	X	X
<b>050 01 05 00</b>	<b>International Standard Atmosphere (ISA)</b>			
<b>050 01 05 01</b>	<b>International Standard Atmosphere (ISA)</b>			
(01)	Explain the use of standardised values for the atmosphere.	B	X	X
(02)	List the main values of the ISA MSL pressure, MSL temperature, the vertical temperature lapse rate in the troposphere, height and temperature of the tropopause).	F	X	X
<b>050 01 06 00</b>	<b>Altimetry</b>			
<b>050 01 06 01</b>	<b>Terminology and definitions</b>			
(01)	Define the following terms and explain how they are related to each other: height, altitude, pressure altitude, FL, pressure level, true altitude, true height, elevation, QNH, QFE and standard altimeter setting.	F	X	X
(02)	Describe the terms 'transition altitude', 'transition level', 'transition layer', 'terrain clearance', 'lowest usable flight level'.	B	X	X
<b>050 01 06 02</b>	<b>Altimeter settings</b>			
(01)	Name the altimeter settings associated to height, altitude, pressure altitude and FL.	F	X	X
(02)	Describe the altimeter setting procedures.	B	X	X
<b>050 01 06 03</b>	<b>Calculations</b>			
(01)	Calculate the different readings on the altimeter when the pilot uses different settings (QNH, 1013,25, QFE).	R	X	X
(02)	Illustrate with a numbered example the changes of altimeter setting and the associated changes in reading when the pilot climbs through the transition altitude or descends through the transition level.	R	X	X

Eind- en toetstermen		Tax	PPLA	PPLH
(04)	Explain the influence of the air temperature on the distance between the ground and the level read on the altimeter and between two FLs.	B	X	X
(05)	Explain the influence of pressure areas on the true altitude.	B	X	X
(06)	Determine the true altitude/height for a given altitude/height and a given ISA temperature deviation.	B	X	X
(07)	Calculate the terrain clearance for given atmospheric temperature and pressure conditions.	R	X	X
	<p><i>Note: The following rules shall be considered for altimetry calculations:</i></p> <p>a. <i>All calculations are based on rounded pressure values to the nearest lower hPa;</i></p> <p>b. <i>The value for the barometric lapse rate near mean sea level is 27 ft (8 m) per 1 hPa</i></p> <p>c. <i>To determine the true altitude/height, the following rule of thumb, called the "4%-rule", shall be used: the altitude/height changes by 4% for each 10°C temperature deviation from ISA;</i></p> <p>d. <i>If no further information is given, the deviation of the outside-air temperature from ISA is considered to be constantly the same given value in the whole layer;</i></p> <p>e. <i>The elevation of the airport has to be taken into account. The temperature correction has to be considered for the layer between ground and the position of the aircraft.</i></p>			
<b>050 02 00 00</b>	<b>Wind</b>			
<b>050 02 01 00</b>	<b>Definition and measurement of wind</b>			
<b>050 02 01 01</b>	<b>Definition and measurement</b>			
(01)	Define 'wind' and 'surface wind'.	F	X	X
(02)	State the units of wind direction (degrees true in reports; degrees magnetic from tower) and speed (kt, m/s).	F	X	X
<b>050 02 02 00</b>	<b>Primary cause of wind</b>			
<b>050 02 02 01</b>	<b>Primary cause of wind, pressure gradient, Coriolis force</b>			
(01)	Define the term 'horizontal pressure gradient'.	F	X	X
(02)	Explain how the pressure gradient force acts in relation to the pressure gradient.	B	X	X
(03)	Explain how the Coriolis force acts in relation to the wind.	B	X	X
(04)	Explain the development of the geostrophic wind.	B	X	X
(05)	Indicate how the geostrophic wind flows in relation to the isobars in the northern and in the southern hemisphere.	R	X	X
<b>050 02 02 02</b>	<b>Variation of wind in the friction layer</b>			

Eind- en toetstermen		Tax	PPLA	PPLH
(01)	Describe why and how the wind changes direction and speed with height in the friction layer in the northern and in the southern hemisphere (rule of thumb).	B	X	X
(03)	Name terrain, wind-speed and stability as the main factors that influence the vertical extent of the friction layer.	F	X	X
(04)	Explain the relationship between isobars and wind (direction and speed) in the friction layer over land and over sea.	B	X	X
<b>050 02 02 03</b>	<b>Effects of convergence and divergence</b>			
(01)	Describe atmospheric convergence and divergence.	F	X	X
(02)	Explain the relationship between convergence and divergence on the following: pressure systems at the surface and aloft; wind speed; vertical motion and cloud formation.	B	X	X
<b>050 02 03 00</b>	<b>General global circulation</b>			
<b>050 02 03 01</b>	<b>General circulation around the globe</b>			
(01)	Describe the general global circulation. (Refer to 050 08 01 01)	B	X	X
<b>050 02 04 00</b>	<b>Local winds</b>			
<b>050 02 04 01</b>	<b>Anabatic and katabatic winds, mountain and valley winds, Venturi effects, land and sea breezes</b>			
(01)	Describe and explain anabatic and katabatic winds.	B	X	X
(02)	Describe mountain and valley winds.	B	X	X
(03)	Describe the Venturi effect, convergence in valleys and mountain areas.	B	X	X
(04)	Describe land and sea breezes.	B	X	X
(05)	Describe that local, low-level jet streams can develop in the evening.	B	X	X
<b>050 02 05 00</b>	<b>Mountain waves (standing waves, lee waves)</b>			
<b>050 02 05 01</b>	<b>Origin and characteristics</b>			
(01)	Explain the origin and formation of mountain waves.	B	X	X
(04)	Explain how mountain waves may be identified by their associated meteorological phenomena.	B	X	X
(05)	Describe that mountain wave effects can exceed the performance or structural capability of aircraft.	B	X	X
<b>050 02 06 00</b>	<b>Turbulence</b>			
<b>050 02 06 01</b>	<b>Description and types of turbulence</b>			
(01)	Describe turbulence and gustiness.	B	X	X

Eind- en toetstermen		Tax	PPLA	PPLH
(02)	List the common types of turbulence (convective, mechanical, orographic, frontal, clear air turbulence).	F	X	X
<b>050 02 06 02</b>	<b>Formation and location of turbulence</b>			
(01)	Explain the formation of convective turbulence, mechanical and orographic turbulence and frontal turbulence.	B	X	X
(02)	State where turbulence will normally be found (rough-ground surfaces, relief, inversion layers, cumulonimbus (CB), thunderstorm (TS) zones, unstable layers).	F	X	X
<b>050 03 00 00</b>	<b>Thermodynamics</b>			
<b>050 03 01 00</b>	<b>Humidity</b>		X	X
<b>050 03 01 01</b>	<b>Water vapour in the atmosphere</b>		X	X
(01)	State that the density of moist air is less than the density of dry air of the same temperature.	F	X	X
(02)	Describe the significance for meteorology of water vapour in the atmosphere.	B	X	X
(04)	Define 'saturation of air by water vapour'.	B	X	X
<b>050 03 01 03</b>	<b>Temperature/dew point, relative humidity</b>			
(01)	Define 'dew point'.	F	X	X
(02)	Define 'relative humidity'.	F	X	X
(04)	Explain the diurnal variation of the relative humidity.	B	X	X
(05)	Describe the relationship between temperature and dew point.	B	X	X
<b>050 03 02 00</b>	<b>Change of state of aggregation</b>			
<b>050 03 02 01</b>	<b>Condensation, evaporation, sublimation, deposition, freezing and melting, latent heat</b>			
(01)	Define 'condensation', 'evaporation', 'sublimation', 'deposition', 'freezing and melting' and 'latent heat'.	F	X	X
(03)	Explain the condensation process.	B	X	X
(04)	Explain the nature of and the need for condensation nuclei.	B	X	X
(05)	Explain the effects of condensation on the weather.	B	X	X
(07)	Explain the process of freezing.	B	X	X
(08)	Explain the nature of and the need for freezing nuclei.	B	X	X
(09)	Define 'supercooled water'. (Refer to 050 09 01 01)	F	X	X
(11)	Explain the deposition process.	B	X	X



Eind- en toetstermen		Tax	PPLA	PPLH
(14)	Illustrate all the changes of state of aggregation with practical examples.	R	X	X
<b>050 03 03 00</b>	<b>Adiabatic processes</b>			
<b>050 03 03 01</b>	<b>Adiabatic processes, stability of the atmosphere</b>			
(03)	Explain the variation of temperature of a rising/descending unsaturated air particle (lapse rate = 1°C/100 m or 3°C/1000 ft).	B	X	X
(05)	Explain the variation of temperature of a saturated air particle with changing altitude (average lapse rate at lower levels = 0.6°C/100 m or 1.8°C/1000 ft).	B	X	X
(07)	Define qualitatively and quantitatively the terms 'stable', 'conditionally unstable', 'unstable' and 'indifferent'.	F	X	X
(09)	Explain the effect on the stability of the air caused by advection of air (warm or cold).	B	X	X
<b>050 04 00 00</b>	<b>Clouds and fog</b>			
<b>050 04 01 00</b>	<b>Cloud formation and description</b>			
<b>050 04 01 01</b>	<b>Cloud formation</b>			
(01)	Explain cloud formation by adiabatic cooling, and advection.	B	X	X
(02)	Describe the cloud formation based on the following lifting processes: forced lifting at fronts or over mountains; free convection.	B	X	X
(03)	List cloud types typical for stable and unstable air conditions.	F	X	X
(04)	Summarise the conditions for the dissipation of clouds.	B	X	X
<b>050 04 01 02</b>	<b>Cloud types and cloud classification</b>			
(01)	Describe the different cloud types and their classification.	B	X	X
(02)	Identify by shape cirriform, cumuliform and stratiform clouds.	B	X	X
(03)	Identify by shape and typical level the 10 cloud types (general).	B	X	X
(04)	Describe and identify by shape the following species and supplementary features: castellanus, lenticularis, towering cumulus, and cumulonimbus,	B	X	X
(05)	Distinguish between low-, medium- and high-level clouds according to the World Meteorological Organization's (WMO) 'cloud étage' (including heights) for mid-latitudes.	B	X	X
(06)	Distinguish between ice clouds, mixed clouds and pure water clouds.	B	X	X
<b>050 04 01 03</b>	<b>Influence of inversions on cloud development</b>			
(01)	Explain the influence of inversions on vertical movements in the atmosphere.	B	X	X
(03)	Explain the influence of ground inversion on the formation of fog.	B	X	X
<b>050 04 02 00</b>	<b>Fog, mist, haze</b>			

Eind- en toetstermen		Tax	PPLA	PPLH
<b>050 04 02 01</b>	<b>General aspects</b>			
(01)	Define 'fog', 'mist' and 'haze' with reference to WMO standards of visibility range.	B	X	X
(02)	Explain briefly the formation of fog, mist and haze.	B	X	X
(03)	Name the factors that generally contribute to the formation of fog and mist.	F	X	X
(04)	Name the factors that contribute to the formation of haze.	F	X	X
(05)	Describe freezing fog.	B	X	X
<b>050 04 02 02</b>	<b>Radiation fog</b>			
(01)	Explain the formation of radiation fog.	B	X	X
(02)	Describe the significant characteristics of radiation fog, and its vertical extent.	B	X	X
(03)	Summarise the conditions for the dissipation of radiation fog.	B	X	X
<b>050 04 02 03</b>	<b>Advection fog</b>			
(01)	Explain the formation of advection fog.	B	X	X
(02)	Describe the different possibilities of advection-fog formation (over land, sea and coastal regions).	B	X	X
(04)	Describe the significant characteristics of advection fog.	B	X	X
(05)	Summarise the conditions for the dissipation of advection fog.	B	X	X
<b>050 04 02 04</b>	<b>Sea smoke</b>			
(01)	Explain the formation of sea smoke.	B	X	X
(02)	Describe significant characteristics of sea smoke.	B	X	X
(03)	Summarise the conditions for the dissipation of sea smoke.	B	X	X
<b>050 04 02 05</b>	<b>Frontal fog</b>			
(01)	Explain the formation of frontal fog.	B	X	X
(02)	Describe the significant characteristics of frontal fog.	B	X	X
(03)	Summarise the conditions for the dissipation of frontal fog.	B	X	X
<b>050 04 02 06</b>	<b>Orographic fog (hill fog)</b>			
(01)	Explain the conditions for the development of orographic fog.	B	X	X

Eind- en toetstermen		Tax	PPLA	PPLH
(02)	Describe significant characteristics of orographic fog.	B	X	X
(03)	Summarise the conditions for the dissipation of orographic fog.	B	X	X
<b>050 05 00 00</b>	<b>Precipitation</b>			
<b>050 05 01 00</b>	<b>Development of precipitation</b>			
<b>050 05 01 01</b>	<b><i>Process of development of precipitation</i></b>			
(04)	Explain the development of snow, rain, drizzle and hail.	B	X	X
<b>050 05 02 00</b>	<b>Types of precipitation</b>			
<b>050 05 02 01</b>	<b><i>Types of precipitation, relationship with cloud types</i></b>			
(01)	List and describe the types of precipitation given in the (TAF) and METAR codes (drizzle, rain, snow, snow grains, ice pellets, hail, small hail, snow pellets, freezing drizzle, freezing rain).	B	X	X
(02)	State that, because of their size, hail stones can cause significant damage to aircraft.	F	X	X
(04)	Explain the mechanism for the formation of freezing precipitation.	B	X	X
(05)	Describe the weather conditions that give rise to freezing precipitation.	B	X	X
(06)	Distinguish between the types of precipitation generated in convective and stratiform clouds.	B	X	X
<b>050 06 00 00</b>	<b>Air masses and fronts</b>			
<b>050 06 01 00</b>	<b>Air masses</b>			
<b>050 06 01 01</b>	<b><i>Description, classification and source regions of air masses</i></b>			
(01)	Define the term 'air mass'.	F	X	X
(02)	Describe the properties of the source regions.	B	X	X
(03)	Summarise the classification of air masses by source regions.	B	X	X
(04)	State the classifications of air masses by temperature and humidity at source.	B	X	X
(05)	State the characteristic weather in each of the air masses.	B	X	X
(06)	Name the three main air masses that affect Europe.	F	X	X
(07)	Classify air masses on a surface weather chart.	B	X	X

Eind- en toetstermen		Tax	PPLA	PPLH
	<i>Note: Names and abbreviations of air masses used in examinations:</i> - first letter: <i>humidity</i> <i>continental (c), maritime (m)</i> - second letter: <i>type of air mass</i> <i>Arctic (A), Polar (P), Tropical (T), Equatorial (E)</i>			
<b>050 06 01 02</b>	<b>Modifications of air masses</b>			
(02)	Explain how maritime and continental tracks modify air masses.	B	X	X
(03)	Explain the effect of passage over cold or warm surfaces.	B	X	X
(05)	Assess the tendencies of the stability of an air mass and describe the typical resulting air-mass weather including the hazards for aviation.	R	X	X
<b>050 06 02 00</b>	<b>Fronts</b>			
<b>050 06 02 01</b>	<b>General aspects</b>			
(01)	Describe the boundaries between air masses (fronts).	B	X	X
(02)	Define 'front' and 'frontal zone'.	F	X	X
(03)	Name the global frontal systems (polar front, arctic front).	F	X	X
<b>050 06 02 02</b>	<b>Warm front, associated clouds and weather</b>			
(01)	Define a 'warm front'.	F	X	X
(02)	Describe the cloud, weather, ground visibility and aviation hazards at a warm front depending on the stability of the warm air.	B	X	X
(04)	Describe the structure, slope and dimensions of a warm front.	B	X	X
(05)	Sketch a cross-section of a warm front showing weather, cloud and aviation hazards.	R	X	X
<b>050 06 02 03</b>	<b>Cold front, associated clouds and weather</b>			
(01)	Define a 'cold front'.	F	X	X
(02)	Describe the cloud, weather, ground visibility and aviation hazards at a cold front depending on the stability of the warm air.	B	X	X
(04)	Describe the structure, slope and dimensions of a cold front.	B	X	X
(05)	Sketch a cross section of a cold front showing weather, cloud and aviation hazards.	R	X	X
<b>050 06 02 04</b>	<b>Warm sector, associated clouds and weather</b>			
(01)	Describe fronts and air masses associated with the warm sector.	B	X	X
(02)	Describe the cloud, weather, ground visibility and aviation hazards in a warm sector.	B	X	X
(04)	Sketch a cross-section of a warm sector showing weather, cloud and aviation hazards.	R	X	X

Eind- en toetstermen		Tax	PPLA	PPLH
(p01)	State the seasonal differences in the weather in the warm sector.	F	X	X
<b>050 06 02 05</b>	<b>Weather behind the cold front</b>			
(01)	Describe the cloud, weather, ground visibility and aviation hazards behind the cold front.	B	X	X
<b>050 06 02 06</b>	<b>Occlusions, associated clouds and weather</b>			
(01)	Define the term 'occlusion'.	F	X	X
(02)	Define a cold occlusion.	F	X	X
(03)	Define a warm occlusion.	F	X	X
(05)	Sketch a cross section of occlusions, showing weather, cloud and aviation hazards.	R	X	X
<b>050 06 02 07</b>	<b>Stationary front, associated clouds and weather</b>			
(01)	Define a 'stationary front'.	F	X	X
(02)	Describe the cloud, weather, ground visibility and aviation hazards in a stationary front.	B	X	X
<b>050 06 02 08</b>	<b>Movement of fronts and pressure systems, life cycle</b>			
(01)	Describe the movements of fronts and pressure systems.	B	X	X
(03)	State the difference in the speed of movement of cold and warm fronts.	F	X	X
<b>050 06 02 09</b>	<b>Changes of meteorological elements at a frontal wave</b>			
(01)	Sketch a plan and a cross-section of a frontal wavesystem (warm front, warm sector, and cold front) and illustrate the changes of pressure, temperature, surface wind.	B	X	X
<b>050 07 00 00</b>	<b>Pressure systems</b>			
<b>050 07 02 00</b>	<b>Anticyclone</b>			
<b>050 07 02 01</b>	<b>Anticyclones, types, general properties, ridges and subsidence</b>			
(02)	Describe the effect of high- level convergence in producing areas of high pressure at ground level.	B	X	X
(03)	Describe air-mass subsidence, its effect on the environmental lapse rate, and the associated weather.	B	X	X
(05)	Describe the formation of ridges. (Refer to 050 08 03 02)	B	X	X
(07)	Describe the properties of and the weather associated with ridges.	B	X	X
<b>050 07 03 00</b>	<b>Non frontal depressions</b>			
<b>050 07 03 01</b>	<b>Thermal, orographic, polar and secondary depressions; troughs</b>			

Eind- en toetstermen		Tax	PPLA	PPLH
(01)	Describe the effect of high-level divergence in producing areas of low pressure at ground level.	B	X	X
(02)	Describe the formation and properties of thermal, orographic (lee lows), and polar depressions.	B	X	X
(03)	Describe the formation, the properties and the associated weather at troughs.	B	X	X
(p01)	Define a cold pool (NL: koude put) and describe its properties with regard to dimension, duration of life, geographical position, seasons, and weather activity	F	X	X
<b>050 08 00 00</b>	<b>Climatology</b>			
<b>050 08 03 00</b>	<b>Typical weather situations in the mid-latitudes</b>			
<b>050 08 03 01</b>	<b><i>Westerly situation (westerlies)</i></b>			
(01)	Identify on a weather chart the typical westerly situation with travelling polar front waves.	R	X	X
<b>050 08 03 02</b>	<b><i>High pressure area</i></b>			
(01)	Describe the high pressure zones with the associated weather.	B	X	X
(02)	Identify on a weather chart high-pressure regions.	R	X	X
<b>050 08 04 00</b>	<b>Local winds and associated weather</b>			
<b>050 08 04 01</b>	<b><i>Foehn, Mistral, Scirocco</i></b>			
(01)	Describe the classical mechanism for the development of Foehn winds.	B	X	X
(02)	Describe the weather associated with Foehn winds.	B	X	X
(03)	Describe the formation of, the characteristics of, and the weather associated with the Mistral and Scirocco.	B	X	X
<b>050 09 00 00</b>	<b>Flight hazards</b>			
<b>050 09 01 00</b>	<b>Icing</b>			
<b>050 09 01 01</b>	<b><i>Conditions for ice accretion</i></b>			
(01)	Summarise the general conditions under which ice accretion occurs on aircraft (temperatures of outside air; temperature of the airframe; presence of supercooled water in clouds, fog, rain and drizzle).	B	X	X
(02)	Explain the general weather conditions under which ice accretion occurs in a Venturi carburettor.	B	X	X
(04)	Explain the formation of supercooled water in clouds, rain and drizzle ( <i>Refer to Subject 050 03 02 01</i> ).	B	X	X
(07)	Indicate in which circumstances ice can form on an aircraft on the ground: air temperature, humidity, precipitation.	R	X	X
(08)	Explain in which circumstances ice can form on an aircraft in flight: inside clouds, in precipitation, outside clouds and precipitation.	B	X	X

Eind- en toetstermen		Tax	PPLA	PPLH
<b>050 09 01 02</b>	<b>Types of ice accretion</b>			
(01)	Define 'clear ice'.	F	X	X
(02)	Describe the conditions for the formation of clear ice.	B	X	X
(05)	Define 'rime ice'.	F	X	X
(06)	Describe the conditions for the formation of rime ice.	B	X	X
(12)	Define 'hoar frost'.	F	X	X
(13)	Describe the conditions for the formation of hoar frost.	B	X	X
<b>050 09 01 03</b>	<b>Hazards of ice accretion, avoidance</b>			
(02)	Describe, in general, the hazards of icing.	B	X	X
(04)	Describe the position of the dangerous zones of icing in fronts and in the different precipitation types.	B	X	X
(05)	Indicate the possibilities of avoidance - in the flight planning: weather briefing, choice of track; - during flight: recognition of the dangerous zones, choice of appropriate track.	R	X	X
<b>050 09 02 00</b>	<b>Turbulence</b>			
<b>050 09 02 01</b>	<b>Effects on flight, avoidance</b>			
(01)	State the ICAO qualifying terms for the intensity of turbulence (See ICAO ATM Doc 4444).	F	X	X
(02)	Describe the effects of turbulence on an aircraft in flight.	B	X	X
(03)	Indicate the possibilities of avoidance - in the flight planning: weather briefing, choice of track and altitude; - during flight: choice of appropriate track and altitude.	R	X	X
<b>050 09 03 00</b>	<b>Wind shear</b>			
<b>050 09 03 01</b>	<b>Definition of wind shear</b>			

Eind- en toetstermen		Tax	PPLA	PPLH
(01)	Define: - vertical wind shear; - horizontal wind shear; - shear of the vertical wind (updraft or downdraft wind shear).	F	X	X
(02)	Define 'low level wind shear'.	F	X	X
<b>050 09 03 02</b>	<b><i>Weather conditions for wind shear</i></b>			
(01)	Describe the conditions, where and how wind shear can form (e.g. thunderstorms, squall lines, fronts, inversions, land and sea breeze, friction layer, relief) and the possibilities of avoidance.		X	X
<b>050 09 04 00</b>	<b>Thunderstorms</b>	B		
<b>050 09 04 01</b>	<b><i>Conditions for and process of development, forecast, location, type specification</i></b>			
(01)	Name the cloud types which indicate the development of thunderstorms.	F	X	X
(02)	Describe the different types of thunderstorms, their location, the conditions for and the process of development, and list their properties (air mass thunderstorms, frontal thunderstorms, squall lines, supercell storms, orographic thunderstorms).	B	X	X
<b>050 09 04 02</b>	<b><i>Structure of thunderstorms, life history</i></b>			
(01)	Assess the average duration of single-cell thunderstorms.	R	X	X
(03)	Summarise the flight hazards associated with of a fully developed thunderstorm.	R	X	X
(04)	Indicate on a sketch the most dangerous zones in and around a single-cell thunderstorm.	R	X	X
<b>050 09 04 03</b>	<b><i>Electrical discharges</i></b>			
(05)	Describe the effect of lightning strike on aircraft and flight execution.	B	X	X
<b>050 09 04 04</b>	<b><i>Development and effects of downbursts</i></b>			
(01)	Define the term 'downburst'.	F	X	X
(02)	Distinguish between macroburst and microburst.	B	X	X
(05)	Give the typical duration of a downburst.	F	X	X
(06)	Describe the effects of downbursts.	B	X	X
<b>050 09 04 05</b>	<b><i>Thunderstorm avoidance</i></b>			



Eind- en toetstermen		Tax	PPLA	PPLH
(01)	Explain how the pilot can anticipate each type of thunderstorms: through pre-flight weather briefing, observation in flight, use of specific meteorological information, use of information given by ground weather radar.	B	X	X
(02)	Describe practical examples of flight techniques used to avoid the hazards of thunderstorms.	B	X	X
<b>050 09 05 00</b>	<b>Whirlwind, waterspout and dust devils</b>			
<b>050 09 05 01</b>	<b><i>Properties and occurrence</i></b>			
(p01)	Define whirlwind or waterspout, and dust devil.	F	X	X
(05)	State the dimensions of waterspouts and dust devils.	B	X	X
<b>050 09 08 00</b>	<b>Hazards in mountainous areas</b>			
<b>050 09 08 01</b>	<b><i>Influence of terrain on clouds and precipitation, frontal passage</i></b>			
(01)	Describe the influence of a mountainous terrain on cloud and precipitation.	B	X	X
<b>050 09 08 02</b>	<b><i>Vertical movements, mountain waves, wind shear, turbulence, ice accretion</i></b>			
(01)	Describe the vertical movements, wind shear and turbulence that are typical of mountain areas.	B	X	X
(02)	Indicate on a sketch of a chain of mountains the turbulent zones (mountain waves, rotors).	R	X	X
<b>050 09 08 03</b>	<b><i>Development and effect of valley inversions</i></b>			
(03)	Describe the effects of a valley inversion for an aircraft in flight.	B	X	X
<b>050 09 09 00</b>	<b>Visibility-reducing phenomena</b>			
<b>050 09 09 01</b>	<b><i>Reduction of visibility caused by precipitation and obscurations</i></b>			
(01)	Describe the reduction of visibility caused by precipitation.	B	X	X
(02)	Describe the reduction of visibility caused by obscurations: - fog, mist, haze, smoke, volcanic ash.	B	X	X
(04)	Describe the differences between the ground and flight visibility, slant and vertical visibility when an aircraft is above or within a layer of haze or mist	B	X	X
<b>050 09 09 02</b>	<b><i>Reduction of visibility caused by other phenomena</i></b>			
(01)	Describe the reduction of visibility caused by low drifting and blowing snow.	B	X	X
(05)	Describe the reduction of visibility caused by the position of the sun relative to the visual direction.	B	X	X
(06)	Describe the reduction of visibility caused by the reflection of the sun's rays from the top of layers of haze, fog and clouds.	B	X	X
<b>050 10 00 00</b>	<b>Meteorological information</b>			

Eind- en toetstermen		Tax	PPLA	PPLH
<b>050 10 01 00</b>	<b>Observation</b>			
<b>050 10 01 01</b>	<b>Surface observations</b>			
(01)	Define 'gusts', as given in the METARs and TAFs.	F	X	X
(03)	Define 'visibility'.	F	X	X
(05)	Define 'prevailing visibility'.	F	X	X
(06)	Define 'ground visibility'.	F	X	X
(07)	List the units used for visibility (m, km, statute mile).	F	X	X
(08)	Define 'runway visual range'.	F	X	X
(16)	State the clouds which are indicated in METAR and TAF (CB, TCU).	F	X	X
(17)	Define 'oktas'.	F	X	X
(18)	Define 'cloud base'.	F	X	X
(19)	Define 'ceiling'.	F	X	X
(20)	Name the unit and the reference level used for information about cloud base (ft).	F	X	X
(21)	Define 'vertical visibility'.	F	X	X
(22)	Explain briefly how and when the vertical visibility is measured.	B	X	X
(23)	Name the units used for vertical visibility (ft).	F	X	X
(25)	Name the units of relative humidity (%) and dew-point temperature (°C, °F).	F	X	X
<b>050 10 01 02</b>	<b>Radiosonde observations</b>			
(01)	Describe the principle of radiosondes.	B	X	X
<b>050 10 01 03</b>	<b>Satellite observations</b>			
(02)	Name the main uses of satellite pictures in aviation meteorology.	F	X	X
(03)	Describe the different types of satellite imagery.	B	X	X
(04)	Interpret qualitatively the satellite pictures in order to get useful information for the flights: - location of clouds (distinguish between stratiform and cumuliform clouds);	R	X	X

Eind- en toetstermen		Tax	PPLA	PPLH
(05)	Interpret qualitatively the satellite pictures in order to get useful information for the flights: - location of fronts.	R	X	X
<b>050 10 01 04</b>	<b>Weather radar observations (Refer to 050 09 04 05)</b>			
(01)	Describe the basic principle and the type of information given by a ground weather radar.	B	X	X
(02)	Interpret ground weather radar images.	R	X	X
<b>050 10 01 05</b>	<b>Aircraft observations and reporting</b>			
(01)	Describe routine air-report and special air-report (ARS).	B	X	X
(02)	State the obligation of a pilot to prepare air-reports.	F	X	X
<b>050 10 02 00</b>	<b>Weather charts</b>			
<b>050 10 02 01</b>	<b>Significant weather charts</b>			
(01)	Decode and interpret significant weather charts (for low level flights only).	R	X	X
<b>050 10 02 02</b>	<b>Surface charts</b>			
(01)	Recognise the following weather systems on a surface weather chart (analysed and forecast): ridges, troughs; fronts; warm sector high- and low pressure areas.	R	X	X
(02)	Determine from surface weather charts the wind direction and speed.	R	X	X
<b>050 10 02 03</b>	<b>Upper-air charts</b>			
(05)	Describe forecast upper-wind and temperature charts.	B	X	X
<b>050 10 03 00</b>	<b>Information for flight planning</b>			
<b>050 10 03 01</b>	<b>Aviation weather messages</b>			
(01)	Describe, decode and interpret the following aviation weather messages: METAR, SPECI, TREND, TAF, SIGMET, AIRMET, Graphic Low Level Forecast (GLLFC), special air-report.	B	X	X
(03)	Describe the general meaning of MET REPORT and SPECIAL REPORT.	B	X	X
(04)	List, in general, the cases when a SIGMET and an AIRMET are issued.	F	X	X
(05)	Describe, decode (by using a code table) and interpret the following messages: runway state message (as written in a METAR), GAFOR.	B	X	X

Eind- en toetstermen		Tax	PPLA	PPLH
<b>050 10 03 02</b>	<b>Meteorological broadcasts for aviation</b>			
(01)	Describe the meteorological content of broadcasts for aviation: - meteorological information for aircraft in flight VOLMET; - automatic terminal information service ATIS.	B	X	X
<b>050 10 03 03</b>	<b>Use of meteorological documents</b>			
(02)	List the information that a flight crew can receive from meteorological services for pre-flight planning and apply the content of these information on a designated flight route.	F	X	X
(03)	List the meteorological information that a flight crew can receive from services during flight and apply the content of these information for the continuation of the flight.	F	X	X
<b>050 10 03 04</b>	<b>Meteorological warnings</b>			
(01)	Describe and interpret aerodrome warnings and wind shear warnings and alerts.	B	X	X
<b>050 10 04 00</b>	<b>Meteorological services</b>			
<b>050 10 04 01</b>	<b>World area forecast system and meteorological offices</b>			
(03)	Name the meteorological watch offices (MWOs) as the provider for SIGMET and AIRMET information.	F	X	X
(04)	Name the aeronautical meteorological stations as the provider for METAR and MET reports.	F	X	X

Eind- en toetstermen		Tax	PPLA	PPLH
070 00 00 00	OPERATIONAL PROCEDURES			
071 02 00 00	Special operational procedures and hazards (general aspects)			
071 02 07 00	Wind shear and microburst			
071 02 07 02	<i>Actions to avoid and actions taken during encounter</i>			
(01)	Describe the effects of and actions required when encountering windshear, at take-off and approach.	B	X	X
(02)	Describe the precautions to be taken when windshear is suspected, at take-off and approach.	B	X	X
(03)	Describe the effects of and actions required following entry into a strong downdraft windshear.	B	X	X

## Wijzigingen toetsmatrijs LVPAMET

Wijzigingen versie 17-09-2018 (t.o.v. versie 12-11-2013):

### Algemene wijzigingen:

- De leerdoelen van de vakken die in één examen worden afgenomen, zijn in één document gevoegd.
- De leerdoelen zijn genummerd.
- De kolom met 'opmerkingen' is verwijderd. Alle informatie die (niet) geldt voor PPL staat (niet) in de LO's.

### Grote wijzigingen Meteorology:

- 050 01 01 02: vierde LO is verwijderd.
- 050 01 02 03: tweede en vierde LO zijn verwijderd.
- 050 01 02 06: leerdoel (01) is toegevoegd en eerste LO is verwijderd.
- 050 01 03 01: derde LO is verwijderd.
- 050 01 03 03: leerdoel (03) is toegevoegd.
- 050 01 04 01: derde LO is verwijderd.
- 050 01 05 01: derde en vierde LO zijn verwijderd.
- 050 01 06 03: derde LO is verwijderd.
- 050 02 01 01: derde LO is verwijderd.
- 050 02 04 01: leerdoel (05) is toegevoegd.
- 050 02 05 01: leerdoel (05) is toegevoegd.
- 050 03 01 01: leerdoel (04) is toegevoegd.
- 050 03 01 02: gehele onderdeel 'Mixing ratio' is verwijderd.
- 050 03 01 03: tweede en vijfde LO zijn verwijderd.
- 050 03 03 01: eerste, tweede, vierde, zesde, achtste, negende en tiende LO zijn verwijderd.
- 050 04 01 01: derde LO is verwijderd.

- 050 04 01 03: tweede en vierde LO zijn verwijderd.
- 050 04 02 02: tweede LO is verwijderd.
- 050 04 02 03: tweede LO is verwijderd.
- 050 04 02 04: tweede LO is verwijderd.
- 050 04 02 05: tweede LO is verwijderd.
- 050 04 02 06: eerste LO is verwijderd.
- 050 05 01 01: eerste, tweede en derde LO zijn verwijderd. Bij het vierde LO (04) zijn snow, rain, drizzle wel van toepassing voor PPL.
- 050 05 02 01: leerdoel (02) is toegevoegd en vijfde LO is verwijderd.
- 050 06 02 01: vierde LO is verwijderd.
- 050 06 02 04: leerdoel (p01) is toegevoegd.
- 050 06 02 06: vierde en vijfde LO zijn verwijderd.
- 050 06 02 08: derde LO is verwijderd.
- 050 07 01 00: dit onderdeel (met 050 07 01 01 en twee LO's) is verwijderd.
- 050 07 02 01: eerste LO is verwijderd.
- 050 07 03 01: leerdoel (p01) is toegevoegd.
- 050 08 03 01: tweede LO is verwijderd.
- 050 08 03 03 en 050 08 03 04: beide onderdelen (met bijbehorende leerdoelen) zijn verwijderd.
- 050 09 01 02: derde, zesde, zevende, achtste en elfde LO zijn verwijderd.
- 050 09 03 03: dit onderdeel (met bijbehorende leerdoelen) is verwijderd.
- 050 09 04 02: eerste en derde LO zijn verwijderd.
- 050 09 04 03: eerste LO is verwijderd.
- 050 09 05 00: 'Tornadoes' veranderd in 'Whirlwind, waterspout and dust devils'.
- 050 09 06 00 'Inversions' verwijderd (verplaatst naar Flight Performance and Planning).
- 050 09 08 01: tweede LO is verwijderd.
- 050 09 08 02: derde LO is verwijderd.
- 050 09 08 03: eerste en tweede LO zijn verwijderd.
- 050 10 01 01: eerste, tweede, derde, vijfde, zevende, twaalfde, dertiende, veertiende, vijftiende, zestiende, zeventiende, achttiende, zeventwintigste, achtentwintigste, negentwintigste, eenendertigste en tweeëndertigste LO zijn verwijderd.
- 050 10 01 02: tweede LO is verwijderd.
- 050 10 01 03: eerste LO is verwijderd.
- 050 10 02 01: tweede LO is verwijderd.
- 050 10 02 03: tweede LO is verwijderd.
- 050 10 03 01: tweede LO is verwijderd.
- 050 10 03 03: eerste LO is verwijderd.

## **Grote wijzigingen OPS:**

- 071 02 07 00: onderdeel 071 01 00 00 (met bijbehorende leerdoelen) is verwijderd (i.v.m. doublure, zie 050 09 03 01 en 050 09 03 02).
- 071 02 07 02: vierde LO is verwijderd (i.v.m. doublure, zie 050 09 04 04).

## **Kleine wijzigingen Meteorology:**

- Nummering van de leerdoelen is toegevoegd (in lijn met nummering van EASA LO's).
- De leerdoelen van Operational Procedures die bij Meteo worden getoetst, zijn aan dit document toegevoegd.
- De kolom met 'opmerkingen' is verwijderd. Alle informatie die (niet) geldt voor PPL staat (niet) in de LO's.
- 050 01 02 05 (02): Aanpassing van 'Explain the characteristics of inversions and of an isothermal layer' naar 'Explain the characteristics of inversions and of an isothermal layer concerning stability and vertical motions'.
- 050 01 02 06 (02): Aanpassing van 'Explain the cooling and warming of the air on the earth or sea surfaces' naar 'Explain the cooling/warming of the air by heat transfer to/from the earth or sea surfaces.'
- 050 01 02 06 (04): 'Distinguish between the influence of low or high clouds, thick or thin clouds' verwijderd.

- 050 02 01 01 (01): Aanpassing van 'Define wind' naar 'Define 'wind' and 'surface wind'.
- 050 02 02 02 (03): Aanpassing van 'Name the factors that influence the vertical extent of the friction layer' naar 'Name terrain, wind-speed and stability as the main factors that influence the vertical extent of the friction layer'.
- 050 02 02 02 (04): Aanpassing van 'Explain the relationship between isobars and wind (direction and speed)' naar 'Explain the relationship between isobars and wind (direction and speed) in the friction layer over land and over sea'.
- 050 02 04 01 (04): Aanpassing van 'Describe and explain land and sea breezes, sea breeze front' naar 'Describe land and sea breezes'.
- 050 03 01 01 (01): Aanpassing van 'Describe humid air' naar 'State that the density of moist air is less than the density of dry air of the same temperature'.
- 050 03 02 01 (01): 'deposition' is toegevoegd.
- 050 03 03 01 (03): Aanpassing van 'Explain the variation of temperature with changing altitude' naar 'Explain the variation of temperature of a rising/descending unsaturated air particle (lapse rate = 1°C/100 m or 3°C/1000 ft)'.
- 050 03 03 01 (05): Aanpassing van 'Explain the difference in temperature lapse rate between saturated and unsaturated air' naar 'Explain the variation of temperature of a saturated air particle with changing altitude (average lapse rate at lower levels = 0.6°C/100 m or 1.8°C/1000 ft)'.
- 050 04 01 01 (01): 'conduction' en 'radiation' zijn verwijderd.
- 050 04 01 01 (02): 'unorganised lifting in thin layers and turbulent mixing' is verwijderd.
- 050 04 01 02 (01): Aanpassing van 'Describe cloud types and cloud classification' naar 'Describe the different cloud types and their classification'.
- 050 04 01 02 (04): 'fractus, humilis, mediocris, congestus, calvus, capillatus and virga' zijn verwijderd.
- 050 04 02 01 (05): 'and ice fog' is verwijderd.
- 050 04 02 04: de term 'Steam fog' is aangepast in 'Sea smoke'. Bij de drie leerdoelen (01), (02) en (03) is 'steam fog' ook aangepast in 'sea smoke'.
- 050 06 02 01 (02): 'frontal surface' verwijderd en 'frontal zone' staat niet meer tussen haakjes.
- 050 06 02 04 (01): 'Define' is vervangen door 'Describe'.
- 050 06 02 07 (01) en (02): 'quasi-stationary front' is verwijderd.
- 050 06 02 08 (03): 'Explain' is vervangen door 'State'.
- 050 08 04 01: 'Bora, Ghibli and Khamsin' verwijderd. Deze zijn ook bij leerdoel (03) verwijderd.
- 050 09 01 03 (04): 'in stratiform and cumuliform clouds' is verwijderd.
- 050 09 01 03 (05): 'altitude' is verwijderd.
- 050 09 04 02 (01) en (04): toegevoegd dat het om single-cell thunderstorms gaat.
- 050 09 04 05 (01): 'Airborne weather radar' en 'use of the stormscope' verwijderd.
- 050 10 01 01 (16): Aanpassing van 'List the clouds considered in meteorological reports, and how they are indicated in METARs (TCU, CB) naar 'State the clouds which are indicated in METAR and TAF (CB, TCU)'.
- 050 10 04 01: alleen de 'MWO's as the provider for SIGMET and AIRMET information' en de 'aeronautical meteorological stations as the provider for METAR and MET reports' zijn in de LO's (03) en (04) opgenomen.

## Kleine wijzigingen OPS:

- 071 02 07 02: verwijzingen zijn verwijderd.