Subject No 42 Meteorology

Each subject has been given a subject number and each topic within that subject a topic number. These reference numbers will be used on 'knowledge deficiency reports' and will provide valuable feed back to the examination candidate.

Sub Topic	Syllabus Item
42.2	**The Atmosphere**
42.2.2	Describe the composition of the atmosphere.
42.2.4	List the trace elements present in the atmosphere.
42.2.6	Explain the importance of the various elements in the atmosphere.
42.2.8	Describe the effect of latitude and altitude on water vapour presence.
42.2.10	Draw a graph of temperature versus altitude from the earth's surface to the stratopause, and explain why the shape of the curve is different in the troposphere compared to the stratosphere.
42.2.12	Describe the following features of the troposphere: (a) approximate vertical extent at low, middle and high latitudes; (b) molecular mass compared to the total in the atmosphere; (c) weather and turbulence.
42.2.14	Define: (a) tropopause; (b) insolation.
42.2.16	With respect to the tropopause: (a) draw the idealised global tropopause showing approximate altitudes and position of jet streams; (b) explain why the altitude of the tropopause varies with latitude; (c) explain how the tropopause pattern responds to the seasons in the northern and southern hemisphere.
42.2.18	Describe the relationship between the temperature of the tropopause and the temperature of the lower stratosphere.
42.2.20	Explain the relationship between angle of insolation, atmospheric temperature and tropopause height.
42.2.22	Explain why the stratosphere is generally devoid of cloud and turbulence.
42.4	**Atmospheric Pressure**
42.4.2	Define 'atmospheric pressure'.
42.4.4	State the meteorological unit of pressure used in Australasia and the USA.

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42.4.6	Explain the principle of operation of the: (a) mercury barometer; (b) aneroid barometer.
42.4.8	Define ‘pressure lapse rate’.
42.4.10	Explain the relationship between air temperature and pressure lapse rate.
42.4.12	Define ‘absolute temperature’.
42.4.14	Calculate pressure lapse rates given temperatures and pressure levels.
42.4.16	State the average pressure lapse rate in the lower troposphere.
42.4.18	Define ‘isobar’.
42.4.20	Define the following pressure systems, and state the direction of circulation around the systems in both hemispheres: (a) anticyclone (or ‘high’); (b) ridge of high pressure; (c) depression (or ‘low’); (d) trough of low pressure; (e) col.
42.4.22	Describe the meteorological conditions commonly associated with the weather systems listed in 42.4.20, and explain the causes.
42.4.24	With respect to the semi-diurnal variation of pressure: (a) describe the process; (b) explain the cause(s) of the semi-diurnal variation of pressure; (c) state the latitudes where the semi-diurnal variation of pressure is most evident.
42.4.26	Define ‘pressure gradient’.
42.4.28	Explain the cause of pressure gradient and the factors that determine its strength.
42.4.30	Describe the relationship between pressure gradient, isobars and windspeed.
42.4.32	State the conditions on which the International Standard Atmosphere (ISA) is based.
42.4.34	Explain the importance and application of the ISA to aviation.
42.4.36	State the temperature and pressure lapse rates in the ISA.
42.4.38	Convert ISA temperature at altitude to °C ambient and vice versa.

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42.4.40	Define: (a) altitude; (b) height; (c) QNH; (d) QFE; (e) QNE.
42.4.42	Demonstrate proficiency in determining altimeter indications and/or aircraft altitude when altimeter subscale settings are incorrect.
42.6	**Temperature and Heat Exchange Processes**
42.6.2	Define ‘temperature’.
42.6.4	Describe the following units of measurement of temperature: (a) Celsius; (b) Fahrenheit; (c) Absolute (Kelvin).
42.6.6	Demonstrate proficiency in converting Celsius to Fahrenheit and Absolute, and any combination of these.
42.6.8	Describe the principle of operation of the: (a) mercury thermometer; (b) thermistor (as used in radiosondes).
42.6.10	Define ‘radiation’.
42.6.12	Explain the relationship between the temperature of a heat source and radiation frequency.
42.6.14	State the frequency band and wave length of: (a) solar radiation; (b) terrestrial radiation.
42.6.16	Explain what is meant by ‘solar radiation’, and state the components, and their percentage values, that make up solar radiation.
42.6.18	Explain how the components of solar radiation are affected by: (a) absorption; (b) reflection; (c) scattering.

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42.6.20	Explain what is meant by: (a) sky radiation; (b) global solar radiation.
42.6.22	Describe the effect of the following on the amount of solar radiation received by earth: (a) distance between sun and earth; (b) altitude of the sun; (c) length of day.
42.6.24	Explain what is meant by: (a) solstice; (b) equinox.
42.6.26	Explain what is meant by 'terrestrial radiation', and state the type of radiation involved.
42.6.28	List the atmospheric constituents that have the potential to hinder the escape of terrestrial radiation.
42.6.30	Explain the 'greenhouse' effect.
42.6.32	Explain what is meant by: (a) the 'atmospheric window'; (b) the 'energy budget'.
42.6.34	Explain how the atmosphere is warmed through the processes of: (a) conduction; (b) convection; (c) latent heat.
42.6.36	Explain what is meant by: (a) sensible heat; (b) specific heat.
42.6.38	With the aid of graphs, describe the diurnal variation of surface air temperature.
42.6.40	Explain how, and why, the following factors influence the diurnal variation of surface air temperature: (a) type of surface; (b) oceans and other large water areas;

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	(c) water vapour;
	(d) cloud;
	(e) the wind.
42.6.42	Describe the main characteristics of oceanic, maritime and continental climates.
42.8	**Atmospheric Moisture**
42.8.2	Define the following, and explain the processes involved in each:
	(a) condensation;
	(b) evaporation;
	(c) precipitation;
	(d) melting;
	(e) freezing;
	(f) sublimation;
	(g) deposition;
	(h) super saturation.
42.8.4	Explain what is meant by 'partial vapour pressure' of a gas in the atmosphere.
42.8.6	Explain how:
	(a) evaporation of water can lead to the saturation vapour pressure of moist air;
	(b) temperature affects the saturation vapour pressure of moist air;
	(c) the saturation vapour pressure of moist air over an ice surface compares to that over water.
42.8.8	State the effect of changes in water vapour pressure on atmospheric pressure.
42.8.10	Explain the effect of an ice surface, or high air temperature, on the saturation vapour pressure of moist air.
42.8.12	Plot a typical graph of water vapour at saturation against temperature, and calculate relative humidity from information provided by the graph.
42.8.14	Define latent heat and explain how changes in the state of moisture result in the release of, or demand for, latent heat.
42.8.16	Describe the effects of air temperature, water content of air, the wind, and atmospheric pressure on the rate of evaporation.
42.8.18	State the relationship between density of water, temperature and volume.
42.8.20	Explain what is meant by the terms:
	(a) absolute humidity;

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	(b) humidity mixing ratio;
	(c) relative humidity;
	(d) saturation content.
42.8.22	Define dew point temperature, and state:
	(a) the approximate change to the dew point temperature with increasing altitude;
	(b) the main factor that can alter the value of the dew point temperature.
42.8.24	Describe the relationship between absolute humidity, air temperature, dew point temperature, and relative humidity.
42.8.26	Describe the diurnal variation of relative humidity.
42.8.28	Explain the method of operation of the:
	(a) wet bulb/dry bulb hygrometer;
	(b) hair hygrometer;
	(c) lithium chloride element.
42.8.30	Explain the effect of moisture on the density of air.
42.10	**The Wind**
42.10.2	Explain the relationship between insolation and movement of air, both horizontally and vertically.
42.10.4	Explain the effect of Coriolis force on the movement of air in the northern and southern hemisphere, and state the direction of the force and its strength relative to the flow of air.
42.10.6	Formulate Coriolis force and demonstrate proficiency in correct interpretation of the formula.
42.10.8	Describe the effect of Coriolis force and pressure gradient on the movement of air relative to the isobars.
42.10.10	Define:
	(a) geostrophic wind;
	(b) gradient wind.
42.10.12	Describe the inter-relation between pressure gradient, Coriolis force, and centripetal (cyclostrophic) force on the curvature of isobars around high and low pressure systems in the northern and southern hemisphere.
42.10.14	Given equal spacing between isobars, explain why the wind strength is stronger around a high than around a low.

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42.10.16	Define the following terms: (a) gust; (b) lull; (c) squall; (d) veering; (e) backing.
42.10.18	Describe the principles of the friction layer, and describe the effect of the layer on the low level wind velocity.
42.10.20	For the northern and southern hemisphere: (a) describe the diurnal variation of the surface wind; (b) state the change in wind velocity when climbing out of, or descending into, the friction layer.
42.10.22	Explain the use of the geostrophic wind scale and state the conditions when corrections must be made to the readings.
42.10.24	State Buys Ballot's law.
42.10.26	Describe the application of Buys Ballot's law in determining areas of high and low pressure, and on establishing possible errors in altimeter readings.
42.10.28	Describe vertical and horizontal wind shear.
42.10.30	Describe the effect of vertical and horizontal wind shear on aircraft operations.
42.12	**Stability (of air)**
42.12.2	Explain what is meant by stable, unstable, and neutrally stable air.
42.12.4	Explain what is meant by environment lapse rate (ELR) and demonstrate proficiency in interpreting different ELRs on a temperature versus altitude graph.
42.12.6	Describe the following processes: (a) adiabatic process; (b) non-adiabatic process; (c) isobaric process.
42.12.8	Explain what is meant by Dry Adiabatic Lapse Rate (DALR), and state its approximate value.
42.12.10	Using temperature versus altitude graphs, explain how stability and instability of unsaturated air can be determined.
42.12.12	Explain what is meant by Saturated Adiabatic Lapse Rate (SALR), state its approximate value, and explain why this value increases with increasing altitude.

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42.12.14	Using temperature versus altitude graphs, explain how stability and instability of saturated air can be determined.
42.12.16	Explain what is meant by: (a) absolute stability; (b) absolute instability; (c) conditional stability/instability.
42.12.18	Explain what is meant by "super adiabatic lapse rate".
42.12.20	Describe what is meant by Lifting Condensation Level (LCL) aka the Rising Condensation Level (RCL)
42.12.22	State the types of cloud usually associated with stable and unstable air immediately above the LCL.
42.12.24	Given an ELR, isothermal dew point, and orographic details, determine LCL, cloud tops (if applicable), and cloud type(s). The given items may be switched to require determination of dew point, LCL, or associated particulars.
42.12.26	Describe what is meant by Convective Condensation Level (CCL) and state the associated type of cloud.
42.12.28	Given an ELR, determine the surface temperature required to produce convective cloud commencing from the CCL.
42.12.30	Explain the effect of the following on the height of the CCL: (a) warmer or colder surface temperatures; (b) changes in dew point value.
42.12.32	Explain the effect of mixing of air and turbulence on the ELR.
42.12.34	Explain what is meant by: (a) convective stability; (b) convective instability; (c) diurnal instability; (d) latent instability; (e) super adiabatic lapse rate.
42.14	**Local Winds**
42.14.2	Explain the processes involved in the development of the: (a) sea breeze; (b) land breeze; (c) katabatic wind;

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	(d) anabatic wind.
42.14.4	In global terms, describe the following items associated with sea breezes:
	(a) strength of the sea breeze;
	(b) daily and seasonal timing of the sea breeze;
	(c) cloud formations;
	(d) precipitation;
	(e) wind shear;
	(f) turbulence.
42.14.6	In global terms, describe the following items associated with katabatic and anabatic winds:
	(a) strength of the winds;
	(b) daily and seasonal timing of the winds;
	(c) cloud and fog formation;
	(d) turbulence.
42.14.8	Explain the formation, characteristics and flight conditions associated with:
	(a) fohn winds;
	(b) mountain waves including standing or lee waves;
	(c) low level jets.
42.14.10	With regard to the fohn wind, given environment lapse rates, isothermal dew points and mountain crest elevations, determine:
	(a) cloud bases on windward and lee sides;
	(b) temperatures at a stated lee side datum.
	NOTE: The given items above may be interchanged to present similar problem solving.
42.14.12	Describe the factors associated with rotor streaming.
42.16	**Inversions**
42.16.2	Define ‘inversion’.
42.16.4	Explain the effect of inversions on:
	(a) formation and development of cloud;
	(b) visibility;
	(c) turbulence;

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	(d) relative humidity and dew point;
	(e) stability of air.
42.16.6	Describe typical flight conditions in the presence of inversions.
42.16.8	Explain the factors involved with:
	(a) radiation inversion;
	(b) turbulence inversion;
	(c) subsidence inversion;
	(d) frontal inversion.
42.18	**Cloud**
42.18.2	Define 'cloud'.
42.18.4	Describe the function of hygroscopic nuclei in the condensation process.
42.18.6	Describe:
	(a) the predominant causes that can produce rising of air and formation of cloud;
	(b) the effect of latent heat release on stability inside cloud and its influence on the resulting type of cloud.
42.18.8	Describe three causes that tend to slow down the growth of water drops once droplets have formed on nuclei.
42.18.10	Name two processes that can provide/enhance buoyancy of air.
42.18.12	List the factors that determine the rate at which falling water drops evaporate below cloud base, and describe the variants of each factor.
42.18.14	Describe the relationship between latitude, air temperature, relative humidity, dew point, water content of cloud, and cloud base.
42.18.16	List the vertical dimensions of the three main cloud layers in:
	(a) low latitudes;
	(b) mid latitudes;
	(c) high latitudes.
42.18.18	Name and describe the appearance and characteristics of the ten main types of cloud sub-divided as:
	(a) high cloud;
	(b) middle cloud;
	(c) low cloud.

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42.18.20	Describe conditions to be expected with each type of cloud with respect to: (a) turbulence; (b) icing; (c) precipitation.
42.18.22	Explain the formation and development of artificial cloud.
42.18.24	Explain the meaning of the term 'okta'.
42.18.26	In terms of cloud amount, explain what is meant by: (a) SKC; (b) FEW; (c) SCT; (d) BKN; (e) OVC; (f) CAVOK.
42.18.28	Describe how cloud and cloud base are reported.
42.18.30	Describe the principle of operation, operational effectiveness and limitations of the: (a) cloud searchlight; (b) laser to ceilometer.
42.18.32	With regard orographic cloud: (a) explain the influence of stability/instability of air, and different surface dew point values, on the type and vertical extent of cloud formed orographically; (b) describe the formation and characteristics of lenticular cloud.
42.18.34	Describe the factors involved in dispersal of cloud.
42.20	**Precipitation**
42.20.2	With regard to growth of cloud drops to a size sufficiently large to produce precipitation, explain: (a) the Bergeron process; (b) the coalescence process.
42.20.4	Describe the following types of precipitation: (a) rain; (b) drizzle;

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	(c) snow;
	(d) sleet;
	(e) virga;
	(f) hail.
42.20.6	List the types of cloud likely to produce one or more of the above types of precipitation.
42.20.8	Regarding the character of precipitation, explain what is meant by:
	(a) continuous;
	(b) intermittent;
	(c) showers.
42.20.10	Regarding the rate of precipitation, explain what is meant by:
	(a) light;
	(b) moderate;
	(c) heavy.
42.22	**Visibility**
42.22.2	Define (meteorological) visibility.
42.22.4	Explain why solar and lunar illumination do not affect visibility.
42.22.6	Differentiate between visibility distance and visibility range.
42.22.8	Describe the effect of the following on visibility distance:
	(a) precipitation;
	(b) fog and mist;
	(c) haze;
	(d) smoke;
	(e) sea spray.
42.22.10	Describe the following factors affecting visibility range:
	(a) colour background;
	(b) white-out;
	(c) sunlight and moonlight;
	(d) altitude.

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42.22.12	Explain the factors involved in (a) slant range; (b) runway visual range.
42.22.14	Explain the principles of operation, and the limitations, of visibility sensors, e.g. the Handar sensor.
42.24	**Fog**
42.24.2	Differentiate between fog, mist and haze.
42.24.4	Describe the principle of formation, required meteorological conditions, timing, factors affecting extent of, and dispersal of: (a) radiation fog; (b) advection fog; (c) valley fog; (d) upslope fog; (e) cold and warm stream fog; (f) steaming fog; (g) frontal fog.
42.26	**Fronts and Depressions**
42.26.2	Explain what is meant by: (a) synoptic observations; (b) synoptic meteorology.
42.26.4	Describe the Polar Front theory.
42.26.6	Define “airmass” and state the three properties that determine the uniformity of an airmass.
42.26.8	Explain what is meant by “source region” and: (a) state the location of the predominant global source regions; and (b) describe how (source region) anticyclones facilitate airmasses to absorb the characteristics of the source region.
42.26.10	List the classification of airmasses and describe the main characteristics, and typical meteorological conditions, of each.
42.26.12	Explain what is meant by airmass modification.
42.26.14	Describe the likely weather conditions experienced in Australasia during: (a) cold advection;

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	(b) warm advection.
42.26.16	Explain what is meant by "dynamic modification" of an airmass.
42.26.18	Explain the concept of convergence and divergence.
42.26.20	Define "vorticity" and describe the following components of absolute vorticity: (a) vorticity due to curvature; (b) vorticity due to wind shear; (c) vorticity due to earth rotation.
42.26.22	Explain why absolute vorticity is always cyclonic.
42.26.24	Describe the relationship between angular velocity and vorticity.
42.26.26	Explain what is meant by "vorticity advection" and describe its influence on the formation and development of pressure systems and fronts.
42.26.28	With respect to depressions found in mid latitudes of the southern hemisphere, describe the development and associated cloud of: (a) the typical mid latitude depression; and (b) the polar depression.
42.26.30	Describe the effect of the following on the intensity of fronts, and on the extent of cloud and precipitation: (a) amount of moisture in the warm rising air; (b) stability or instability of the rising air; (c) the slope of the front; (d) the speed of the front; (e) the temperature contrast across the front.
42.26.32	Draw the symbols, and state the colours, commonly used to denote fronts on weather charts.
42.26.34	With the use of diagrams, explain the factors involved with the Kata-type and Ana-type cold front and warm front in terms of: (a) structure; (b) horizontal and vertical extent; (c) cloud types, including their typical bases and tops; (d) precipitation; (e) orientation of the freezing level; (f) the speed of the front.

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42.26.36	Describe the sequence of events with the passage of the 'idealised' cold front and warm front in both hemispheres in terms of: (a) pressure trend; (b) temperature trend; (c) cloud; (d) precipitation; (e) visibility; (f) dew point trend; (g) relative humidity trend.
42.26.38	Explain factors involved in the formation and development of: (a) warm occlusions; (b) cold occlusions.
42.26.40	State the typical weather conditions during the passage of a warm sector depression.
42.26.42	Explain the associated weather, and factors involved, in the formation and development of: (a) an orographic depression; (b) a thermal (heat type) depression.
42.28	**Thunderstorms**
42.28.2	Discuss the conditions required for the development of thunderstorms.
42.28.4	Explain the influence of latent heat in the development of CB clouds.
42.28.6	Describe the effect of entrainment of colder air aloft on the development of CB clouds.
42.28.8	Describe the processes involved in lightning.
42.28.10	State the three stages of development of CB clouds, and describe the main factors involved in each stage.
42.28.12	Explain the factors involved in regeneration of thunderstorms.
42.28.14	Describe the following types of thunderstorm: (a) orographic type; (b) heat type (thermally induced); (c) convergence type; (d) nocturnal equatorial type;

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	(e) cold stream type;
	(f) frontal type.
42.28.16	Describe the following hazards associated with flight in the presence of thunderstorms:
	(a) turbulence;
	(b) vertical draughts;
	(c) gusts and squalls;
	(d) wind shear;
	(e) icing;
	(f) lightning;
	(g) hail;
	(h) noise;
	(i) loss of instruments and impairment of accuracy.
42.28.18	Describe the precautions, techniques and procedures commonly followed during flight through thunderstorms.
42.28.20	With respect to downbursts, microbursts and tornadoes, describe their:
	(a) formation and development;
	(b) recognition;
	(c) structure;
	(d) precipitation;
	(e) turbulence and draughts;
	(f) hazards to aviation;
	(g) most likely locations – globally.
42.30	**Icing**
42.30.2	Explain the following processes:
	(a) freezing;
	(b) melting;
	(c) deposition;
	(d) sublimation.
42.30.4	Define “latent heat of fusion”.

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42.30.6	Describe the processes involved when water changes to ice through the unstable supercooled stage to the stable solid state.
42.30.8	Explain the function of heat energy (expressed in joules) in the process of changing the temperature of water, and changing the state of water.
42.30.10	Explain the sequence of events when supercooled water is disturbed by an aircraft in flight.
42.30.12	Describe the processes involved in the formation and development of: (a) clear (aka translucent or glaze) ice; (b) rime (aka opaque) ice; (c) hoar frost; (d) freezing rain.
42.30.14	Explain the process involved in hail formation.
42.30.16	Describe the formation and characteristics of: (a) soft hail; (b) snow pellets.
42.30.18	Describe the following factors that influence the rate of ice accretion: (a) cloud water content; (b) aircraft characteristics; (c) kinetic heating; (d) adiabatic heating or cooling.
42.30.20	Explain the effect on the height of the freezing level when stable saturated air or unstable saturated air is lifted orographically.
42.30.22	State and describe the dangers of icing in aircraft operations.
42.30.24	Describe the dangers of snow accumulation on aircraft while on the ground and in flight.
42.30.26	Describe the principles of operation, and functions, of the following de-icing/anti-icing methods: (a) mechanical; (b) thermal; (c) fluid, including the properties and use of Freezing Point Depressant (FPD) fluids.

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42.30.28	Describe the factors involved in, and possible remedies for, engine intake icing associated with: (a) piston engines; (b) turbine (jet) engines.
42.30.30	State: (a) the potential for ice accretion in the 10 main cloud types and in lenticular cloud. (b) the type of ice to be expected in each cloud type; (c) the height bands relative to the freezing level where clear or rime ice can be expected in each cloud type.
42.30.32	Describe the effect of airframe icing on the operation of aircraft when experiencing: (a) light icing; (b) moderate icing (and draw the associated symbol); (c) severe icing (and draw the associated symbol).
42.32	**Turbulence**
42.32.2	Define ‘turbulence”.
42.32.4	Differentiate between turbulence and draughts.
42.32.6	Describe the cause(s), factors involved, and techniques commonly used to avoid or minimise: (a) mechanical turbulence – small and large scale; (b) thermally induced turbulence; (c) turbulence due to wind shear; (d) wake turbulence.
42.32.8	Describe the effects on aircraft operations of the following types of turbulence, and draw the associated symbol where applicable: (a) light turbulence; (b) moderate turbulence; (c) severe turbulence.
42.34	**Upper Air Meteorology**
42.34.2	Define: (a) contour line; (b) thermal wind;

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	(c) isotherm;
	(d) thickness line.
42.34.4	State the information that can be obtained from spacing and orientation of contour lines.
42.34.6	Demonstrate proficiency in interpreting information contained on a contour chart.
42.34.8	Explain the factors involved in determining a thermal wind.
42.34.10	Explain why the wind at progressively higher altitudes in mid latitudes tends to become westerly.
42.34.12	Using the thermal wind formula, demonstrate proficiency in determining upper winds given:
	(a) data to calculate the thermal gradient;
	(b) the thickness of the associated layer;
	(c) the wind velocity at the base of the associated layer.
42.34.14	Explain why isotherms and thickness lines shown on a thickness chart serve identical purposes.
42.34.16	Describe the vertical variation of pressure systems with:
	(a) low level depressions with a cold core;
	(b) low level depressions with a warm core;
	(c) low level anticyclones with a cold core;
	(d) low level anticyclones with a warm core.
42.34.18	State the characteristic slope (“lean”) of axis of cold depressions and warm anticyclones with altitude in the southern hemisphere.
42.34.20	Define “jet stream”.
42.34.22	Describe the structure of a jet stream including explanations of wind shear and turbulence.
42.34.24	List the four principal jet streams located globally in the troposphere.
42.34.26	Regarding the Southern Hemisphere polar jet stream, describe its:
	(a) association with polar fronts and thermal gradients;
	(b) location relative to the frontal interface;
	(c) usual, or typical, altitude;
	(d) intensity and latitudinal location in winter compared to summer;
	(e) preferred regions of turbulence.

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42.34.28	Regarding the Southern Hemisphere subtropical jet stream, describe/state: (a) the origin of its associated thermal gradient; (b) its location relative to the fractured tropopause; (c) its usual altitude; (d) the region where the worst turbulence is generally found.
42.34.30	State the season during which jet streams are more active as the result of differing global thermal gradients.
42.34.32	With respect to (clear air) turbulence associated with jet streams, describe or state: (a) the relationship between wind shear value and severity of turbulence; (b) the regions where clear air turbulence is likely to be found; (c) the effect on the severity of turbulence where mountain waves and jet stream combine.
42.34.34	With respect to cloud formations associated with jet streams, describe or state: (a) the type of cloud commonly found on the warm side of the jet stream; (b) the type of cloud commonly found on the cold side of the jet stream.
42.34.36	Describe how a pilot can anticipate the location and altitude of jet streams, and what telltale signs are often present in flight to locate a jet stream.
42.34.38	With respect to polar and subtropical jet streams in both hemispheres, list their locations and characteristics in terms of: (a) average wind velocity (direction and speed); (b) average pressure altitude; (c) typical maximum wind speed; (d) average latitudinal location.
42.36	**Tropical Meteorology**
42.36.2	State the approximate latitudes in which tropical meteorology is said to apply.
42.36.4	With the use of diagrams, explain the tropical Hadley Cell.
42.36.6	Explain what is meant by: (a) meteorological (or thermal) equator; (b) equatorial trough; (c) inter-tropical convergence zone (ITCZ); (d) doldrums;

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	(e) horse latitudes;
	(f) South Pacific convergence zone.
42.36.8	Describe the seasonal location of the equatorial trough, and explain the reasons for the change in location.
42.36.10	State the region where maximum convergence, convection and cloud developments are found relative to the equatorial trough.
42.36.12	Explain the essential difference between 'equatorial trough' and 'inter-tropical convergence zone'.
42.36.14	Describe the weather, icing, turbulence and cloud-related factors commonly associated with:
	(a) an 'active' ITCZ;
	(b) an 'inactive' ITCZ.
42.36.16	Describe the origin, preferred location, and characteristics of the South Pacific Converge Zone.
42.36.18	With the aid of diagrams, explain the following aspects of the 'trade winds' in both hemispheres of the Pacific ocean:
	(a) pattern;
	(b) anti-cyclonic subsidence and associated meteorological conditions;
	(c) approximate horizontal and vertical limits;
	(d) typical wind velocity normally found above the trade wind zone;
	(e) seasonal changes in location and their effect on wind direction;
	(f) typical wind strengths, including variation in strength during the summer and winter;
	(g) the effect of the trade winds on the weather experienced in island groups and northern Australia.
42.36.20	Describe the following disturbances experienced in tropical latitudes:
	(a) individual cumulus disturbances;
	(b) mesoscale convective areas;
	(c) wave disturbances.
42.36.22	Explain what is meant by "monsoon".
42.36.24	Describe the factors involved in wet monsoons in terms of:
	(a) seasonal factors;
	(b) effect of large land masses and orographic obstructions;

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	(c) preferred location of the major monsoon regions;
	(d) the monsoon effects experienced in Australia.
42.36.26	With regard to the formation, development and decay of tropical cyclones, describe:
	(a) the relationship with the equatorial trough;
	(b) the requirement for, and supply of, thermal energy;
	(c) the effect of high level divergence;
	(d) the mechanics of formation, and characteristics, of the 'cyclone eye';
	(e) the requirement for a 'warm core'.
42.36.28	State the four stages of development of tropical cyclones.
42.36.30	For each stage of development, describe the:
	(a) atmospheric pressure tendency;
	(b) typical wind strengths, including variations in wind velocity in, and either side of, the cyclone eye;
	(c) typical radii of the affected areas;
	(d) associated weather, and the location within the cyclone where the worst conditions are commonly experienced.
42.36.32	Describe the common causes that lead to the decay of tropical cyclones.
42.36.34	State the season during which tropical cyclones are generally experienced.
42.36.36	Explain what is meant by the Walker Circulation based on:
	(a) the factors involved in the east of the South Pacific Ocean;
	(b) the factors involved in the west of the South Pacific Ocean.
42.36.38	Define the ENSO Index, describe the factors involved when the index changes from positive to negative and include the effect of these changes on:
	(a) prevailing winds in tropical and mid latitude regions;
	(b) meteorological conditions experienced in Australasia.
42.36.40	Describe what is meant by 'streamline analysis' and state the reason why this analysis is necessary in tropical latitudes.
42.36.42	State the information that can be obtained from streamline analysis charts.
42.36.44	Define 'isotach' and demonstrate proficiency in interpreting information provided by isotachs on a chart.
42.36.46	Draw examples of streamline patterns commonly shown on streamline charts (e.g. inflows, outflows etc).

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42.38	**The General Circulation.**
42.38.2	Explain what is meant by 'General Circulation".
42.38.4	State the predominant factors that control the transfer of heat around the globe.
42.38.6	Draw a simplified diagram of the tropical Hadley Cells (one in each hemisphere), and the pattern of horizontal mixing in mid and high latitudes of both hemispheres.
42.38.8	Explain what is meant by "Long (Rossby) Waves" and compare the consistency of the long wave pattern in the southern hemisphere with that in the northern hemisphere.
42.38.10	Explain what is meant by 'zonal index', and 'zonal winds'.
42.38.12	Describe 'high zonal index' and 'low zonal index', and state how these situations relate to: (a) the speed and direction of low tropospheric weather systems; and (b) the strength and uniformity of upper level westerlies and jet streams.
42.38.14	Explain what is meant by the term "Short Waves".
42.38.16	Describe the processes involved in the development of a 'blocking anticyclone', and explain its influence on meteorological conditions in New Zealand when the system is to the west of the country and when it is to the east.
42.38.18	Explain what is meant by the terms 'cold pools' and 'warm pools'.
42.40	**Hazardous Meteorological Conditions**
42.40.2	Describe the effects of volcanic ash on aircraft operations.
42.40.4	Describe the risk of, and factors involved in, aquaplaning following heavy precipitation.
42.42	**New Zealand Climatology**
42.42.2	State and explain the three major influences that determine the New Zealand climate.
42.42.4	Discuss the effect of the following winds on meteorological conditions in New Zealand: (a) the northwesterly; (b) the southwesterly; (c) the southeasterly; (d) the northeasterly.
42.42.6	With regard to Auckland, Wellington and Christchurch international airports, describe typical conditions in terms of: (a) the effect of orographic surroundings;

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	(b) common surface winds;
	(c) effect and direction of the sea breeze and land breeze;
	(d) turbulence;
	(e) fog;
	(f) low cloud;
	(g) visibility.
42.44	**Meteorological Services, Reports and Forecasts**
42.44.2	Describe the World Area Forecast System (WAFS), and explain the role played by NZ CAA in providing meteorological services in the Auckland and NZ Domestic FIR
42.44.4	Describe the functions of Automatic Weather Stations and state the standard information normally available to aviation.
42.44.6	Explain the limitations of some data obtained from automatic weather stations.
42.44.8	Describe the information normally obtained from radiosondes and state the principle of operation of instruments and equipment carried by radiosondes.
42.44.10	State the meteorological documentation available to aviation for both domestic and international operations.
42.44.12	For NZ domestic and international operations, interpret, understand and assess information of all descriptions contained in:
	(a) Route forecast (ROFOR);
	(b) Meteorological reports (METAR / SPECI);
	(c) Trend forecasts (TTL);
	(d) Aerodrome forecasts (TAF);
	(e) SIGMET;
	(f) High level area forecasts;
	(g) SPAR;
	(h) Automatic Terminal Information Service (ATIS);
	(i) Aerodrome Weather Information Broadcasts (AWIB);
	(j) Basic Weather Report (BWR);
	(k) Aircraft Reports (PIREP);
	(l) VOLMET.

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42.44.14	With respect to WIND/TEMP charts: (a) determine issue time and validity period; (b) identify the Office issuing the chart; (c) identify the flight level for the chart; (d) explain the meaning of chart symbols; (e) interpret temperature information; (f) interpret wind velocity information including the presence of jet streams.
42.44.16	State the functions, and information available, from the following charts: (a) Effective Wind Component charts; (b) E-TOPS TAT charts.
42.44.18	With respect to Mid-level and High-level SIGWX Prognosis Charts: (a) determine the airspace covered (on the chart); (b) state Significant Weather items shown; (c) determine the Office issuing the chart; (d) determine issue and valid time; (e) identify, interpret and assess significant zones of cloudiness, tropical cyclones, jet streams, clear air turbulence; icing, tropopause height, fronts and depressions.
42.44.20	State the issue time relative to ETD, and usual validity time relative to ETA applicable to Route Forecasts (ROFORs).
42.44.22	With respect to a specific ROFOR: (a) determine the route to which the forecast applies; (b) determine the issue and validity time of the ROFOR; (c) determine, through interpolation if necessary, the forecast wind velocity and temperature at any required pressure altitude; (d) interpret and assess SIGWX information, if included.