a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

FINAL EXAMINATIONS: DECEMBER 2018 - INDIVIDUAL EXAM

Course number: **ATSC 201** Section numbers: 101
Course name: Meteorology of Storms
Duration: 90 minutes for the individual exam; then a 10 minute break; then 50 minute group exam in groups of 4.

Candidate name _____

Student number _____Candidate signature _____

Special instructions: Open books, notes, and calculator. No other electronics (cell phones, iPads, laptops, ear phones). Indicate your name, student ID, Test Form, and all your answers on the Bubble sheet. Each question has only one best answer. Don't leave any questions unanswered (if you don't know the answer, then guess). Good luck!

Instructor names: Roland Stull

This examination consists of 5 pages (including this cover sheet & bubble sheet). Check to ensure that it is complete. Students ARE allowed to separate the bubble sheet from the rest of the exam. Only the bubble sheet will be marked, but students must turn in ALL pages of this exam. Please do NOT re-staple the bubble sheet to the exam packet.

Rules governing formal examinations

1. Each examination candidate must be prepared to produce, upon the request of the invigilator or examiner, his or her UBCcard for identification.

2. Examination candidates are not permitted to ask questions of the examiners or invigilators, except in cases of supposed errors or ambiguities in examination questions, illegible or missing material, or the like.

3. No examination candidate shall be permitted to enter the examination room after the expiration of one-half hour from the scheduled starting time, or to leave during the first half hour of the examination. Should the examination run forty-five (45) minutes or less, no examination candidate shall be permitted to enter the examination room once the examination has begun.

4. Examination candidates must conduct themselves honestly and in accordance with established rules for a given examination, which will be articulated by the examiner or invigilator prior to the examination commencing. Should dishonest behaviour be observed by the examiner(s) or invigilator(s), pleas of accident or forgetfulness shall not be received.

5. Examination candidates suspected of any of the following, or any other similar practices, may be immediately dismissed from the examination by the examiner/invigilator, and may be subject to disciplinary action:
   i. speaking or communicating with other examination candidates, unless otherwise authorized;
   ii. purposely exposing written papers to the view of other examination candidates or imaging devices;
   iii. purposely viewing the written papers of other examination candidates;
   iv. using or having visible at the place of writing any books, papers or other memory aid devices other than those listed above under Special Instructions or authorized by the examiner(s); and,
   v. using or operating electronic devices including but not limited to telephones, calculators, computers, or similar devices other than those authorized by the examiner(s)—(electronic devices other than those authorized by the examiner(s) must be completely powered down if present at the place of writing).

6. Examination candidates must not destroy or damage any examination material, must hand in all examination papers, and must not take any examination material from the examination room without permission of the examiner or invigilator.

7. Examination candidates must follow any additional examination rules or directions communicated by the examiner(s) or invigilator(s).

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TEST FORM

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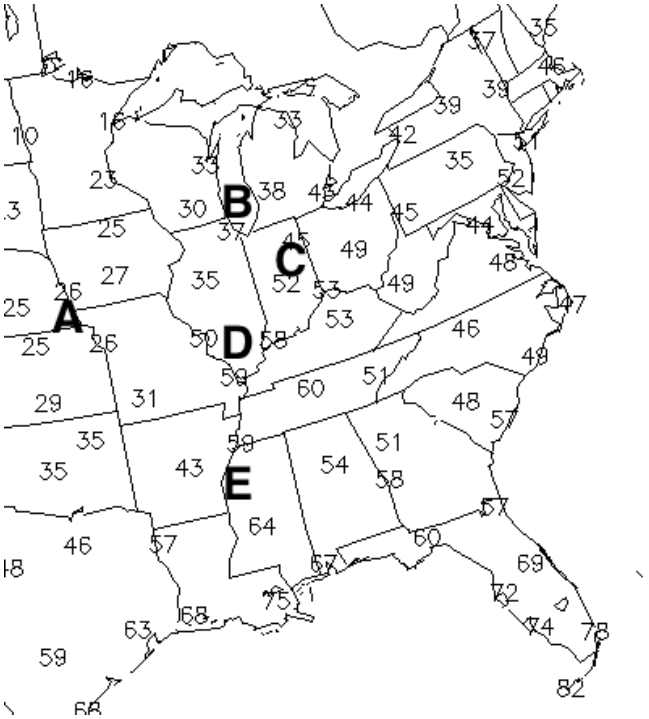
ATSC 201 **Final Exam** Name: _____
Prof. Stull (open books, notes, calculator)
Fall 2018 (90 points ≈ 1 minute/point) Student Number: _____
Write all of your answers on the bubble sheet. Both the bubble sheet and the question sheet will be marked.

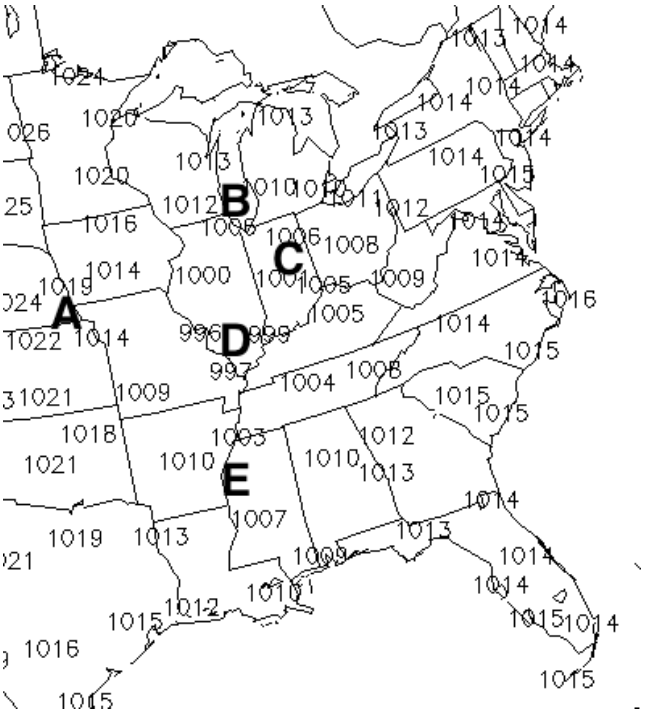
This is TEST FORM "**A**".

Below are 2 weather maps for the same instant in time.

- The **left map** shows **temperatures** in deg F. Please analyze this by drawing and labeling the following isotherms every 10 degF; namely, 80, 70, 60, ..., 10 degF. Label any warm and cold centers.
- The **right map** shows **pressures** in hPa. Please analyze by drawing and labeling the following isobars every 4 hPa; namely, 1024, 1020, 1016, ... , 996 hPa. Identify any High and Low pressure centers.
- Then use the info on both maps to identify frontal zones and fronts, if there are any.

Although these analyses are not graded, you will need to do them to answer the next 6 questions.
(Recall 1000 hPa = 100.0 kPa, but you don't need to do the conversion. Also, don't convert degF to °C.).





1. (4 points) The location of the cold front is at which location? A) B) C) D) E)

2. (4 points) The location of the warm front is at which location? A) B) C) D) E)

3. (4 points) The low center is located closest to which location on the map? A) B) C) D) E)

4. (4 points) Frontal stratiform clouds are most likely over which location? A) B) C) D) E)

5. (4 points) At location A on the map, the near-surface (i.e., boundary layer) wind direction is likely:
   A) north B) east C) south D) west E) (light winds with variable directions)

6. (4 points) A likely short range (1 hour ahead) forecast for location E on the map is
   A) overcast clouds, drizzle, windy and cooler
   B) overcast clouds, light snow, light winds and cooler
   C) thunderstorms, rain showers, windy and warmer
   D) clear skies, warmer, and light winds
   E) thunderstorms, rain showers, windy and cooler

7. (5 points) Which answer has the correct order of cause and effect?
   A) fronts, precipitation, differential heating, extratropical cyclones, Rossby waves, jet stream
   B) Rossby waves, fronts, differential heating, extratropical cyclones, jet stream, precipitation
   C) jet stream, fronts, extratropical cyclones, precipitation, differential heating, Rossby waves
   D) extratropical cyclones, fronts, precipitation, differential heating, Rossby waves, jet stream
   E) differential heating, jet stream, Rossby waves, extratropical cyclones, fronts, precipitation

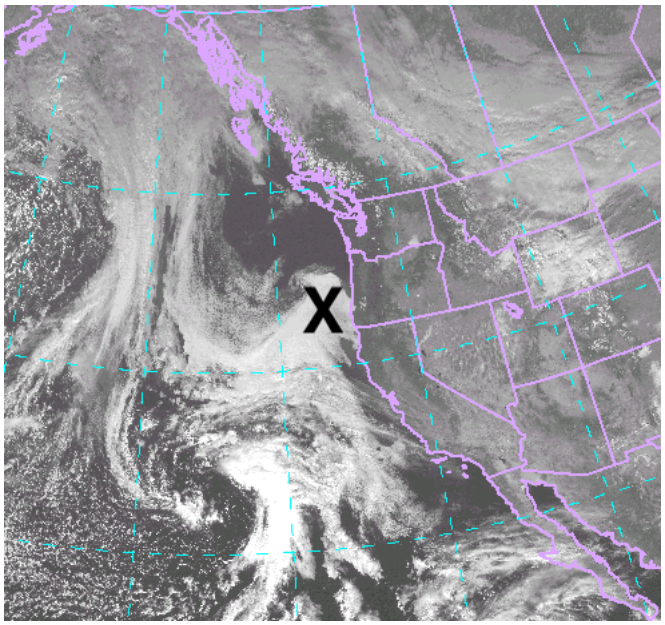
8. (5 points) Which type of front would have thunderstorms well ahead of the surface front?
   A) cold front B) warm front C) stationary front D) cold occlusion E) warm occlusion

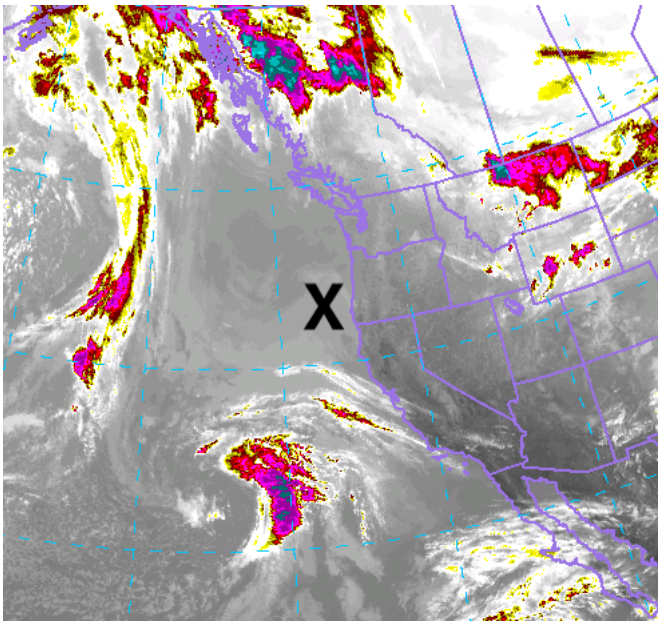
Scenario for the next 2 questions: Over Canada, suppose that a weather pattern had a north-south line dividing warm-air west of the line from cold air east of the line. The warm and cold airmasses affect the atmosphere between 100 and 50 kPa.

9. (5 points) Where is the greatest 100-50 kPa thickness?
   A) west of the line B) on the line C) east of the line D) (The thickness is the same everywhere.)

10. (5 points) If the geostrophic wind is zero at the ground (near 100 kPa), then a 50 kPa it is likely that the geostrophic wind direction is
   A) north B) east C) south D) west E) (the geostrophic winds are nearly calm.)

11. (4 points) The **attached satellite photos** show both visible and IR images of the same location. At the location of the "X", the likely type of clouds are: A) low stratus or fog B) cumulus mediocris
   C) cirrostratus D) cumulonimbus E) (It is not a cloud, it is snow on the earth's surface.)



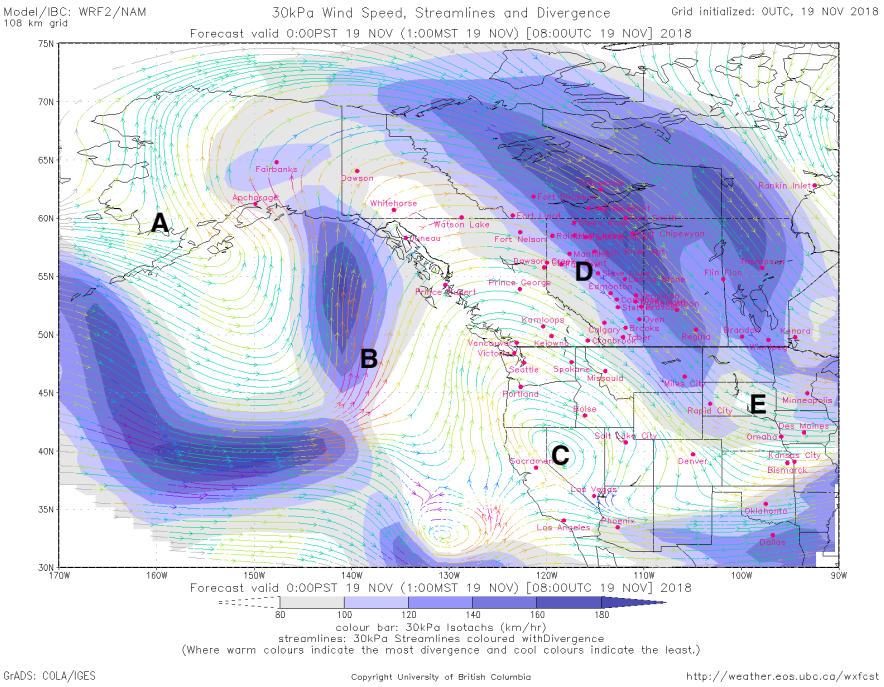


12. (4 points) The new GOES-17 geostationary satellite
   A) orbits the earth at low altitudes and crosses near the north and south poles
   B) orbits the earth at high altitudes and crosses near the north and south poles
   C) orbits the earth at low altitudes and is parked over the equator
   D) orbits the earth at high altitudes and is parked over the equator
   E) does not orbit the earth but is parked at a fixed location in space, so it can observe the whole earth disk

13. (4 points) A jet stream that has extensive north-south meanders is said to be very
A) tempermental B) zonal C) meridional D) extra-tropical E) isogonal

14. (7 points) A barotroic Rossby wave of wavelength 4000 km is centered at 50°N latitude. Its intrinsic phase speed is ___ m/s. A) - 23.9 B) -11.95 C) -5.96 D) 5.96 E) 23.9

15. (5 points) Given the following **<u>30 kPa streamlines (wind directions) and isotachs</u>**. At which location on the map is cyclogenesis most likely? A) B) C) D) E)



16. (4 points) In the Northern Hemisphere, (extratropical cyclones have ___ cores and rotate ___) , while [tropical cyclones have ___ cores and rotate ____].
A) (warm, clockwise) , [warm, clockwise]
B) (warm, counter-clockwise) , [warm, counter clockwise]
C) (cold, clockwise) , [cold, clockwise]
D) (warm, counter-clockwise) , [cold, counter clockwise]
E) (cold, counter-clockwise) , [warm, counter clockwise]

17. (6 points) Near-surface winds of 200 km/hour over the ocean would be rated ___ on the Enhanced Fujita scale if those winds were in a tornado, but would be rated ___ on the Saffir-Simpson wind scale if those winds were in a hurricane. A) (unrated) , (unrated) B) 2, 2 C) 3, 3 D) 4, (unrated) E) (unrated), 3

18. (5 points) The main reason why there are 3 and not 1 latitude bands of general circulation in each of the Northern and Southern Hemispheres is/are: A) monsoon circulations B) Coriolis force C) latent heating D) the continuity effect E) ocean currents

19. (7 points) The average temperature in a 1 km thick layer of dry air is –30°C. If the bottom of this layer is at P = 50 kPa, then the pressure at the top of the layer is at P (kPa) ≈ ?
A) 16.0 B) 43.5 C) 50.0 D) 57.5 E) 156.

-- end of exam --