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**FYS 178 INDIVIDUAL EXAM#02**

Choose the ***single*** best answer for any multiple choice questions. Each problem in Questions (1) – (15) is worth 4 points. Questions (16) - (18) together are worth 40 points. EXAM#02 is worth 100 total points.

(1) The original two sciences represented at the geophysics institute founded by the Bergen Museum were \_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_.

 (a) geology, meteorology

 (b) glaciology, oceanography

 (c) meteorology, glaciology

 (d) oceanography, meteorology, p. 98

(2) In Vilhelm’s report describing the prewar German weather observation network, he mentioned how their field weather services proved valuable for planning in five specific types of operations. Which of the following was ***not*** one of the five types of operations?

 (a) aerial operations

 (b) gas attacks

 (c) ground attacks

 (d) maintenance operations, p. 108

(3) Why did the Zeppelin airships bomb the towns on the English east coast in 1915? Did these locations hold strategic military value?

the Zeppelin airships bombed these towns by mistake; they were carried north and east of their actual target (London) by upper winds of which the Germans had no knowledge [p. 105]

(4) What was one of the necessities listed by Vilhelm for a commercial aviation weather service?

full information of atmospheric conditions from the major landing places for every flight, immediate training of a corps of “scientific meteorologists”, and build a network of wireless telegraphy stations around the country dedicated solely to aviation and weather forecasting (national telegraph service was already overloaded) [p. 114, 115]

(5) Vilhelm expanded the number of weather observations leading up to the summer of 1918 “weather experiment” by installing weather instruments \_\_\_\_\_\_\_\_.

 (a) at the major railroad hubs

 (b) at U-boat watch stations, p. 120

 (c) on fishing vessels

 (d) on the rooftops of buildings in major Norwegian cities

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(6) Select the specific weather feature in the wind field that Vilhelm intended to focus on when making his operational weather forecasts during the summer of 1918.

 (a) downslope winds

 (b) Ekman spiral

 (c) lines of convergence, p. 120

 (d) lines of diffluence

(7) Norwegian naval weather observers stationed at exposed islands and reefs gave high quality wind observations for two reasons. Name one of the two reasons.

through their training they were able to give more precise wind direction obs (within 5 degrees) and the wind measured at these locations would reflect truer atmospheric conditions (no distortion from obstacles or from friction) [p. 121]

(8) What industry did Vilhelm and virtually all his colleagues anticipate would exert an enormous impact on meteorology after World War I had ended?

commercial aviation [p. 137]

(9) What two types of aircraft were in competition in 1919 to serve as the primary transporter in commercial aviation?

 (a) airplane and hot air balloon

 (b) airplane and zeppelin, p. 142

 (c) hot air balloon and helicopter

 (d) hot air balloon and zeppelin

(10) What prominent meteorologist protested and abandoned the profession of meteorology because of the interconnection between meteorology and the military?

 (a) Richardson, p. 145

 (b) Shaw

 (c) Reichelderfer

 (d) Gold

(11) Meteorologists came up with a new type of forecast during World War I which became an absolute necessity to support aviation operations. Give the name of the forecast and its definition.

a short-period (short-term) prediction, a forecast giving detailed weather conditions for a specific location over the next few hours [p. 148]

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(12) The \_\_\_\_\_\_\_\_ of cirrus clouds was used by Jacob Bjerknes to aid in his prediction of the motion of a cyclone.

 (a) brightness

 (b) direction of movement, p. 165

 (c) elevation

 (d) thickness

(13) In a constant theme throughout his life, Vilhelm in 1919 developed a forecasting system with which he might create a stable \_\_\_\_\_\_\_\_\_\_\_ and dominate meteorology \_\_\_\_\_\_\_\_\_\_\_. {Fill in the blanks.} national discipline, internationally (p. 169)

(14) What service did the Bergen group start in the summer 1919 in response to feedback from farmers in West Norway and Trøndelag?

next-day forecasts – better chance of reaching the farmers in time to help them plan their work [p. 156]

(15) Why did the Bergen school’s 1919 cyclone model have a big impact on forecasting practices when Shaw’s innovative prewar cyclone model did not?

Vilhelm purposely connected theory and forecasting practice, while Shaw focused on theory rather than working to apply his theory in operations [p. 174, 177]

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(16) **15 points**

In addition to World War I, a significant shortage impacting Norway during the war helped to make a Norwegian field weather service a reality. Describe

* the type of shortage (shortage in what?),
* the conditions that made the shortage worse in 1917,
* how Vilhelm envisioned that a field weather service could aid those devoted to ending the shortage, and
* how Vilhelm argued from an economic standpoint that the costs of a field weather service would be justified related to the shortage.

[p. 110] food shortages, threat of famine

[p. 110, 111] U.S., a supplier of food to Norway before 1917, entered the war in April 1917…a new U.S.-Norway trade agreement had to be negotiated (restrict trade of neutral powers with the Central Powers {bad guys}) “…prospects for a quick agreement and resumption of grain shipments appeared remote.”

[p. 115] “VB highlighted the savings in labor-intensive periods during planting and hay making: reliable forecasts could help farmers plan their work.”

[p. 115] “VB pointed out before the war that agricultural production was valued at close to two million crowns. If the yield from agriculture could be increased by merely one percent through effective weather forecasting, then the price of the entire forecasting service would be many times paid.”

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(17) **15 points**

Give a reason why Vilhelm’s 1919 forecasting system would not have been possible in nineteenth-century (1800s) forecasting operations related to the

* frequency and number of observations, and
* ability of communications systems

Density of observations at a given time would be too small to accurately identify location of surfaces of discontinuity at that time, frequency of observations would be too small to identify the propagation of surfaces of discontinuity, and if enough observations but poor communications systems, then data would be incapable of being transmitted (via telegraph) to a central forecasting office in time for making a meaningful forecast…the telegraph systems of the time could not transmit observations from so many stations quickly and cheaply enough. [p. 174-176]

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 (18) **10 points**

Match the event with the correct year.

|  |  |
| --- | --- |
| **Event** | **Year of Event** |
| (2,3,4)\_\_\_\_\_Hesselberg becomes head of the Norwegian Meteorological Institute | (1) 1915 |
| (5)\_\_\_\_\_ Food shipments between Germany and Norway are no longer permitted after January of this year | (2) 1916  |
| (1)\_\_\_\_\_An airplane factory is built at the navy air force base in Horton, Norway | (3) 1916  |
| (6-9)\_\_\_\_\_The Norwegian Aerial Transport Corporation is established | (4) 1916  |
| (10)\_\_\_\_\_The German Air Transport Company begins passenger service connecting Berlin, Leipzig, and Weimar | (5) 1917  |
| (6-9)\_\_\_\_\_ An article about a Swedish plan to provide weather forecasts to farmers by telephone is published in *Tidens Tegn* | (6) 1918  |
| (2,3,4)\_\_\_\_\_Shortages in grain and feed concentrate begin to develop in Norway | (7) 1918  |
| (6-9)\_\_\_\_\_Jacob Bjerknes writes his classic paper “On the Structure of Moving Cyclones” | (8) 1918  |
| (6-9)\_\_\_\_\_The first summer weather forecast experiment takes place in Norway | (9) 1918  |
| (2,3,4)\_\_\_\_\_A massive Bergen fire occurs, contributing to housing and office space in the city being extremely scarce and expensive | (10) 1919  |

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Work to be included for Problem \_\_\_\_\_ of Exam \_\_\_\_\_ in class ATMS \_\_\_\_\_