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**ATMS 178 INDIVIDUAL EXAM#01**

Choose the ***single*** best answer for the multiple choice questions. Each problem in Questions (1) – (15) is worth 4 points. Questions (16) - (18) together are worth 40 points. EXAM#01 is worth 100 total points.

(1) Vilhelm and his father won a prize at an electric exhibition in 1881. This exhibition took place in the city of \_\_\_\_\_\_\_\_.

(a) Berlin

(b) Bonn

(c) Oslo

(d) Paris, p. 12

(2) Vilhelm’s generalized circulation theorem produced a result that seemed to contradict the well-established theorems of two prominent scientists. One of the scientists was named \_\_\_\_\_\_\_\_.

(a) Arrhenius

(b) Hertz

(c) Kirchhoff

(d) Lord Kelvin, p. 19

(3) Vilhelm lacked two qualities to persuade theoretical physicists to consider his specific research problems and his research program while at the högskola. List ***one*** of the two qualities.

professional authority and resources [p. 28]

(4) Oceanic surveys that took place during the winters of 1878 and 1879 off the Swedish west coast had been prompted by what event?

(a) The sinking of the *Augsburg* off of the southern coast

(b) A sudden increase in the number of icebergs in the North Sea

(c) The sudden return of coastal herring after a seventy-year absence, p. 40

(d) A tsunami that hit the southwestern Norwegian coast

(5) Ekman, Helland-Hansen, and Sandström, using Vilhelm’s expanded circulation theorem, managed to produce the cornerstones of what twentieth-century scientific discipline?

dynamic oceanography [p. 44]

(6) According to Vilhelm, what was a first step along “the only path” to an exact science of the atmosphere?

(a) locate the international meteorological headquarters in Stockholm

(b) mandate that pressure measurements be made by the same type of barometer

(c) obtain international synchronized upper-air data, p. 54, 55

(d) convince European governments to fund primarily geophysics research

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(7) What link did Vilhelm see in January 1904 between aerial navigation associated with heavier-than-air flying machines and meteorology?

aerial navigation demands to know…the state and motion of the atmosphere so an aerial voyage can be planned & meteorology can only develop if the aeronautics industry provides the observations that will allow us to study completely the atmosphere’s laws [p. 57]

(8) Having committed himself to establishing an atmospheric physics, Vilhelm divided the project into four sub-problems. Which of the following is ***not*** one of the sub-problems?

(a) statics

(b) kinematics

(c) dynamics

(d) torques, p. 61

(9) In Vilhelm’s and Sandström’s effort to put together a weather publication appealing to the international aerological and meteorological communities, they struggled with devising a standard vertical coordinate. What was the vertical coordinate preferred by Vilhelm and Sandström and what was the vertical coordinate in use at the time?

preferred- gravity potential (dynamic meters)

in use at the time- vertical height (meters) [p. 62, 63]

(10) Vilhelm’s trip to London and Berlin in 1910 was not simply for presenting his research, but also served to \_\_\_\_\_\_\_\_ and to \_\_\_\_\_\_\_\_.

(a) promote flying, urge the purchase of the Ekman barometer

(b) offer a rationale for adopting absolute units, promote flying

(c) sell his methods, offer a rationale for adopting absolute units, p. 74

(d) urge the purchase of the Ekman barometer, sell his methods

(11) What prominent German aerologist, who also opposed Vihelm’s reform idea of absolute units in observations, asked if Vilhelm could only help “get things going so that something is accomplished” in his heavily funded Lindenberg observatory?

(a) Arrhenius

(b) Assman, p. 76, 77

(c) Patel

(d) Runge

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(12) With the loss of Devik in 1911, Vilhelm feared for the health of his research program after re-locating to Norway. Name ***one*** of the four conditions in Norway that stoked Vilhelm’s fears.

(1) state funds for permanent full-time assistants were virtually non-existent in Norway, (2) student in natural sciences were scarce in Norway thus meaning an uncertain pool from which to recruit replacements,

(3) lack of office/lab space,

(4) lack of direct access to journals [p. 82, 83]

(13) In his report to the Ministry of Culture in Germany, \_\_\_\_\_\_\_\_ asserted that aeronautical progress was as dependent upon dynamic meteorology as on technological improvement of aircraft structure.

(a) Assmann

(b) Hildebrandsson

(c) Wiener, p. 84

(d) Woodward

(14) Vilhelm was a guest of honor at what event in June 1913?

(a) The grand opening of the Leipzig weather service

(b) The first flight of a heavier-than-air aircraft in Norway

(c) The opening of the giant Zeppelin-airship hangar in Leipzig, p. 89

(d) The coronation ceremony of the first king of Norway

(15) Who was the first doctoral student at the new Leipzig geophysical institute and what was his project under Vilhelm?

Petzold; the relationship between line squalls and lines of convergence [p. 94]

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(16) **15 points**

A key focus of ATMS 178 is to understand the link between the conditions of a society and how society utilizes the sciences to meet its needs arising out of these conditions.

Describe a specific situation that occurred off the Swedish west coast (Bohus County) that for seventy years until the late 1800s was severely impacting the local society. How did this severe impact along the Swedish west coast influence scientific funding in Sweden? How did the emphasis in scientific funding in Sweden have an influence on Vilhelm’s career? In your description, be certain to address:

* the situation having a severe impact on the coastal communities of the Swedish west coast
* a practical example of how Sweden responded to the needs of its coastal communities on the west coast in response to this severe impact
* how Otto Pettersson envisioned an important discovery made by Vilhelm could aid the needs of the local society of the Swedish west coast
* name Vilhelm’s important discovery

🡪 coastal herring had been absent for 70 years until the late 1800s, coastal communities relied on abundant fish supplies to support its fishing industry [p. 40]

🡪 Sweden provided ample funding and conducted ocean surveys along the west coast to make observations that might help the fishing industry understand the prolonged herring absence [p. 40]

🡪 Pettersson embraced VB’s discovery as the scientific breakthrough necessary to establish an oceanographic science with which fishery could be planned [p. 40]. The application of VB’s discovery would provide him with ample funding, authority, and disciples to become a successful geophysics scientist

🡪 general circulation theorem [p. 41]

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(17) **15 points**

Vilhelm Bjerknes learned that to be successful as a scientist, he would have to have three conditions met.

* Name the three conditions.
* In terms of the three conditions, contrast the conditions he faced as a professor in Norway in 1911 with the likely conditions he would face at the new geophysics institute in Leipzig.

[p. 46, 47] conditions;

[1] ability to gain attention and exert authority

[2] healthy amount of research support ($$)

[3] establish a school of disciples and assistants

Norway [p. 82 – 83]

Bad conditions…

Lost assistants and students [3] due to poor funding [2]…state funds for permanent full-time assistants were virtually nonexistent in Norway…uncertain pool from which to recruit replacements

Conditions not conducive to rapid progress…cellar room…lack of space…lack of $$ to hire graphic work assistants…dwindling number of students meant VB could no longer use his lectures to systematize and clarify his research work

VB began to experience the same sense of powerlessness he had experienced in Stockholm as a theoretical physicist…lack of direct access to journals [1], lack of adequate research facilities and lack of sufficient assistants limited his ability even to influence the emerging aerological subdiscipline, let alone transform meteorology in general

{1} aerologists’ and meteorologists’ understanding of his work was limited, {2} his ability to complete the remaining volumes of the project constrained, {3} the possibility of establishing a new generation of scientifically trained aerologists bleak

Germany (Leipzig) [p. 85 – 88]

Good conditions…

VB conceived his appointment as a means of acquiring resources not only to complete his project but to shape meteorology, including aerology, as a scientific discipline…according to Wiener’s plan VB shall reform all of Germany’s meteorology and through that the entire world’s [1]. Leipzig goals {two listed on p. 86} meant it could provide VB the resources necessary to advance and spread his “dynamic meteorology”…by teaching his methods in Leipzig VB could ensure the victory of absolute units and rational methods because his specially trained students would surely become the future leaders of aerology and meteorology [3]…at stake was control of the enormous resources available with the {Leipzig} position…the institute would receive considerable funds [2]…he would collect large amounts of observations and get the methods he and his assistants developed “applied in practice right away and all under my control” [1]…its director might well influence the development of aerology by educating a new generation of meteorologists [1]…immediate tasks…beginning the mass production of aerologists trained in rational methods…starting with seven empty rooms.

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(18) **10 points**

Match the event with the correct year.

|  |  |
| --- | --- |
| **Event** | **Year of Event** |
| (5)\_\_\_\_\_ Carl Anton Bjerknes dies suddenly | (1) 1893 |
| (7)\_\_\_\_\_ Vilhelm gives the opening lecture at the inaugural meeting of the Norwegian ballooning society | (2) 1897 |
| (1)\_\_\_\_\_ Vilhelm arrives in Stockholm to teach at the Stockholm Högskola | (3) 1899 |
| (3)\_\_\_\_\_ Vilhelm demands a leave of absence from teaching at the hogskola to supervise the publishing of his (and his father’s) first volume | (4) 1902 |
| (9)\_\_\_\_\_ International Commission for Scientific Aeronautics Meeting in Vienna | (5) 1903 |
| (6)\_\_\_\_\_ Vilhelm first receives support from the Carnegie Institution | (6) 1906 |
| (8)\_\_\_\_\_ New German weather warning system is established at Lindenberg | (7) 1909 |
| (2)\_\_\_\_\_ Vilhelm’s first assistant, Strindberg, is killed in a ballooning accident | (8) 1911 |
| (10)\_\_\_\_\_ Vilhelm, his family, and his assistants arrive in Leipzig | (9) 1912 |
| (4)\_\_\_\_\_ Arrhenius began nominating Vilhelm for membership on the Nobel physics committee | (10) 1913 |

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