



UNIVERSITY OF ESWATINI
Faculty of Health Sciences
Department of Environmental Health Science

BACHELOR OF SCIENCE IN ENVIRONMENTAL
MANAGEMENT AND WATER RESOURCES

MAIN EXAMINATION PAPER DECEMBER 2018

TITLE OF PAPER : HYDROLOGY

COURSE CODE : EHS 319

DURATION : 2 HOURS

MARKS : 100

INSTRUCTIONS :

- : READ THE QUESTIONS & INSTRUCTIONS CAREFULLY
- : ANSWER ANY FOUR QUESTIONS
- : EACH QUESTION CARRIES 25 MARKS.
- : WRITE NEATLY & CLEARLY
- : NO PAPER SHOULD BE BROUGHT INTO THE EXAMINATION ROOM.
- : BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER.

DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION IS GRANTED BY
THE INVIGILATOR.

QUESTION ONE (25 marks and 5 marks for each question)

- 1A. Figure Q1A shows the atmospheric circulation over earth. From the diagram of air circulation indicate where the high and low pressures lie, the occurrence of precipitations as well as the factor that dictates the direction in which wind is blowing (easterly or westerly winds)

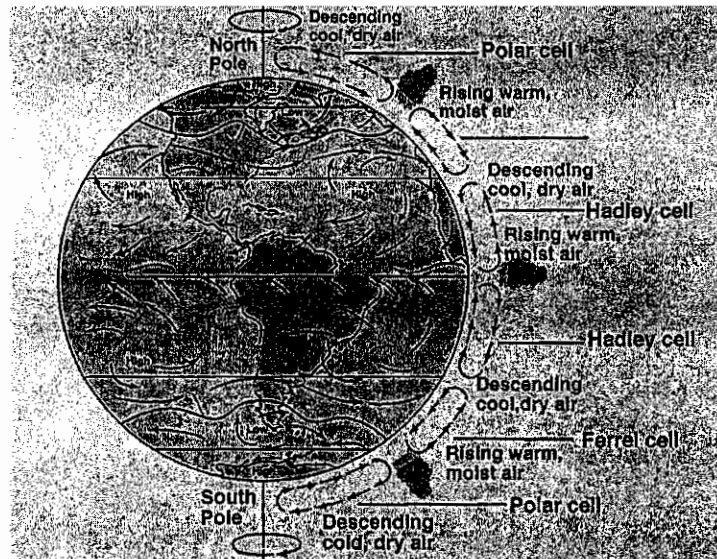


Figure Q1A: Atmospheric circulation

- 1B. Write the equation for the computation of net radiation. Assuming that the albedo of the earth to be 0.4 and 35% of the incoming short wave solar radiation that impinges on earth is reradiated back in the form of long wave radiation, make an estimate of the net radiation as percent of the incoming radiation for i) night conditions , ii) day light clear sky conditions and ii) cloudy day
- 1C. Describe the different alternative mechanism by which rainfall drop growth occurs

- 1D. The relative humidity measurement at two meteorological stations that are nearer to each other produced different results while measuring the relative humidity of air on the same day of time. Station I indicated a vapour pressure of 50 mb when the temperature was 30 °C. Station II indicated a vapour pressure of 30 mb. Refer to the vapor pressure diagram shown below. Discuss about the validity of the two measurement results and indicate the most likely measurement of vapour pressure if the temperature suddenly drops to 15°C.

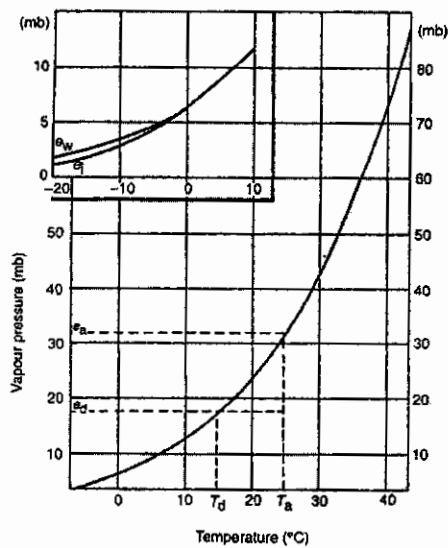
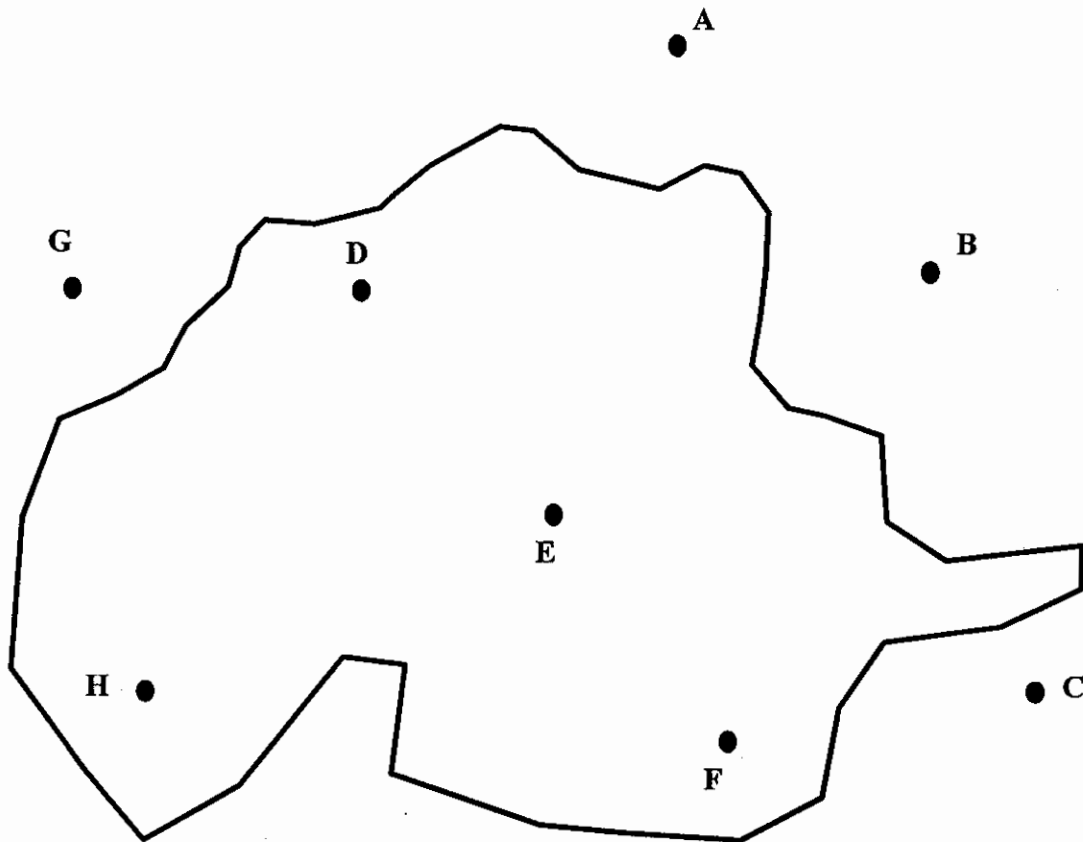


Fig. 1.3 Saturation pressure and air temperature, where $e_a - e_d$ is the saturation deficit and T_d is the dew point temperature.

- 1E. Describe in detail how each of the following factors influence the runoff from a given catchment.
- i. Rainfall intensity
 - ii. Antecedent soil moisture
 - iii. Drainage density
 - iv. Shape
 - v. Pools and ponds

QUESTION TWO (25 Marks)

Draw approximately the Thiessen polygon on the catchment shown below and delineate the part of the area within the catchment that each precipitation measuring station (A, B, C, D, E, F, G, and H) represents. Work your answer on this paper. Detach the paper after working out the answer, write your ID number on the top and include it in your answer sheet.



QUESTION THREE (25 Marks)

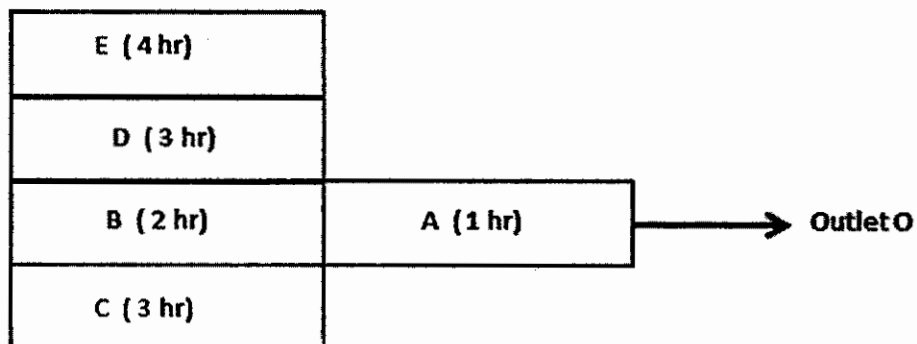
A 2.5 cm of rainfall was recorded on rain gauge station for a rainfall of 6 hour duration falling over a drainage basin area 2000 km². This rain produced the runoff shown in the table below. The base flow component can be taken as 10 m³/sec.

- i. Determine the effective rainfall in cm.....[9 marks]
- ii. Determine the percentage of rainfall that was infiltrated into the soil.[7 marks]
- iii. Determine the ordinates of the 6 hour unit hydrograph.....[9 marks]

Time (hr)	0	6	12	18	24	30	36	42	48	54	60	66
Stream discharge (m ³ /sec)	10	60	170	360	530	320	160	75	35	25	15	10

QUESTION FOUR (25 Marks)

A three hour duration rain of average intensity 1.5 cm/hr falls over an area shown in the figure below. The time of concentration to the stream outlet O of each component area is shown in brackets. In addition, each component area A,B, C, D and E has an area of 4 km². Assume that the runoff coefficient is 0.6 for all the catchment and throughout the duration of rainfall and afterwards. Prepare a table of the hydrograph of runoff in m³/hr, starting from time zero and proceeding to 8 hours.



QUESTION FIVE (25 marks and marks are indicated for each question)

5A. [12 marks]

In a certain alluvial basin with an areal extent of 60 km^2 , 100 Million m^3 of ground water storage, water was pumped in a year and the water table dropped by 8 m during the year. Assume no replenishment, estimate the specific yield of the aquifer. If the specific retention is 15 %, what is the porosity of the soil?

5B. [13 marks]

A fully penetrating well of diameter 0.30 m is located in an unconfined aquifer of saturated depth 60 m. If the drawdown in the well is 10 m for the discharge of 1500 m^3/day and the radius of influence is 600 m, compute the hydraulic conductivity.