

31. True or false, flow lines are always parallel to equipotential lines in an isotropic material?

a) True

b) False

32. Which of the following statements is true?

a) an ellipse is used to sketch equipotential lines that cross a boundary between geologic layers.

b) equipotential lines are always parallel to impermeable boundaries.

c) cannot estimate groundwater flow volume using flow nets.

d) none of the above.

33. Which of the following best represents the equation of continuity (conservation of mass) for a groundwater flow system?

a) Darcy's Law

b) Poiseuille's Law

c) Flow in – flow out = change in stored groundwater

d) Equivalent porous medium approach

34. Which system listed below describes the following groundwater flow equation:

$$K\left(\frac{\partial h}{\partial x^2} + \frac{\partial h}{\partial y^2} + \frac{\partial h}{\partial z^2}\right) = S_s \frac{\partial h}{\partial t}$$

a) homogeneous, two-dimensional, isotropic, transient

b) homogeneous, three-dimensional, isotropic, transient

c) homogeneous, three-dimensional, anisotropic, steady-state

d) homogeneous, two-dimensional, anisotropic, transient

35. Which statement is false?

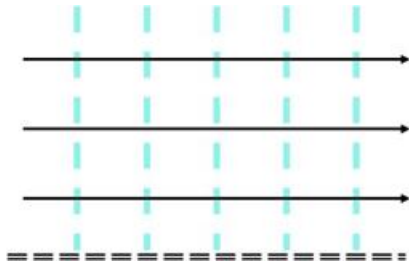
a) Equipotential lines are generated by solving the groundwater flow equation

b) Equipotential lines are sometimes hand-drawn

c) Flow lines are perpendicular to equipotential lines in an anisotropic medium

d) A set of flow lines and equipotential lines constitute a flow net

36. Which type of boundary condition is shown as the dashed horizontal line in the following flow net?



- a) constant head
- b) open
- c) water table
- d) impermeable

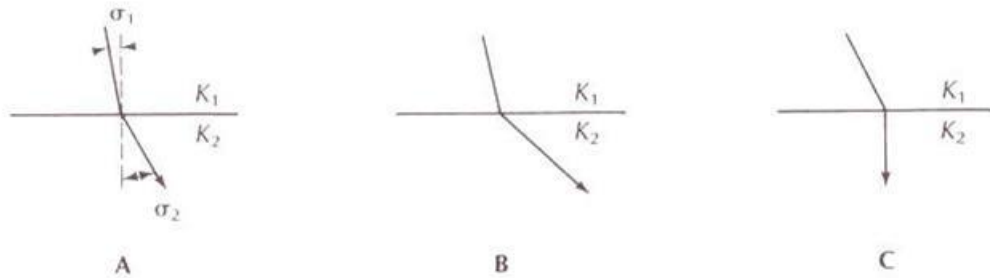
37. Which of the following are assumptions commonly used when hand-drawing flow nets?

- a) Steady-state time conditions
- b) All outer boundary conditions are known
- c) Homogeneous and isotropic hydraulic conductivity
- d) All of the above

38. True or false, in the following equation,  $f$  represents the number of divisions of pressure head in a flow net:  $q' = pKH/f$ ?

- a) True
- b) False

39. In which of the following is  $K_1 > K_2$ ?



- a) A
- b) B
- c) C
- d) A and B

40. True or false, if one of the principal axes of  $K$  is parallel to the hydraulic gradient (for example if groundwater flow and  $K_z$  are north/south), then groundwater flow direction will be perpendicular to the equipotential lines?

- a) True
- b) False

41. True or false, the Dupuit equation was developed for transient groundwater flow?

a) True

b) False

42. Which of the following are assumptions of Dupuit's equation?

a) Hydraulic gradient > slope of water table

b) For small hydraulic gradients, flow lines are vertical and equipotential lines are horizontal

c) For small hydraulic gradients, flow lines are horizontal and equipotential lines are vertical

d) Hydraulic gradient < slope of water table

43. When determining the true direction of groundwater flow in an anisotropic material, which of the following is correct?

a)  $K_x$  is always greater than  $K_z$

b)  $K_z$  is always greater than  $K_x$

c)  $K_x = K_z$

d) None of the above

44. True or false, when sketching flow nets, the volume of groundwater flow is equal in each streamtube?

a) True

b) False

45. At a groundwater (or water-table) divide:

a) groundwater flow is constant

b) groundwater flow is equal to zero

c) groundwater flow is parallel to the z axis

d) none of the above

46. Soil water capacity is given by

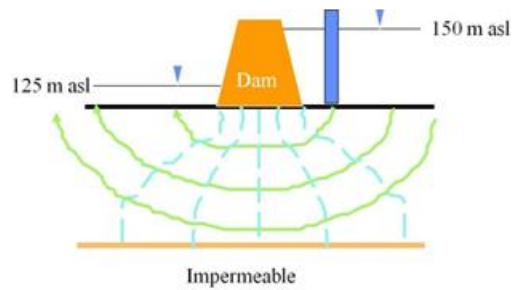
a)  $\Delta\theta/\Delta h_p$

b)  $\Delta h_p/\Delta\theta$

c)  $\Delta\theta \times \Delta h_p$

d) none of the above

47. How many streamtubes exist in the following flow net?



- a) 6
- b) 5
- c) 25
- d) none of the above

48. What is the value of H in the flow net shown in Question 47?

- a) 150 m
- b) 125 m
- c) 6
- d) 25 m

49. The equation shown below is used to calculate

$$K_1/K_2 = \tan \sigma_1 / \tan \sigma_2$$

- a) the angle of refraction of flow lines across a geologic layer boundary
- b) the angle of reflection of flow lines across a geologic layer boundary
- c) the true direction of groundwater flow in anisotropic materials
- d) the true direction of groundwater flow in isotropic materials

50. Which system listed below describes the following groundwater flow equation:

$$K_x \frac{d^2 h}{dx^2} = S_s \frac{\partial h}{\partial t}$$

- a) homogeneous, one-dimensional, isotropic, transient
- b) homogeneous, two-dimensional, isotropic, transient
- c) homogeneous, one-dimensional, isotropic, steady-state
- d) homogeneous, two-dimensional, anisotropic, transient