

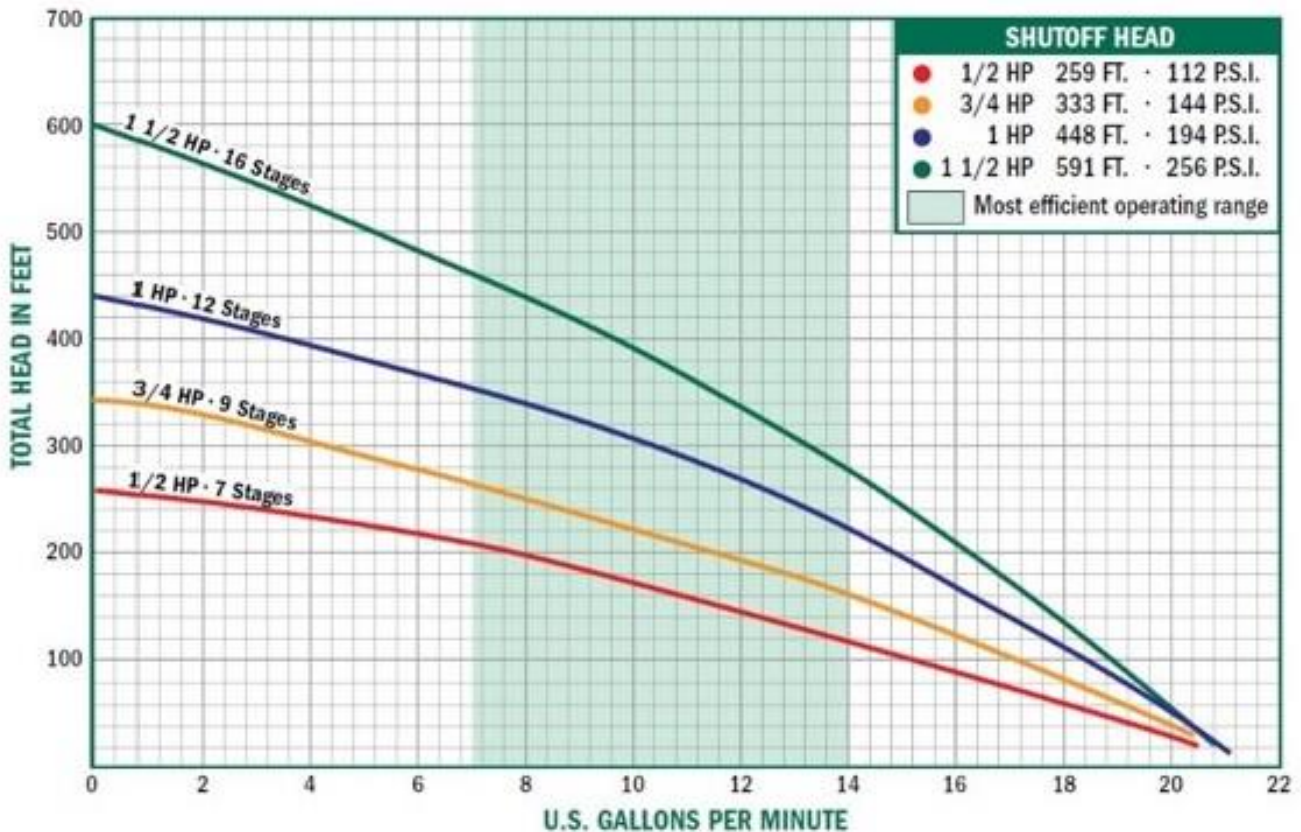
# Water Wells Fundamentals Part 2- Bold Copy

RV 2.16.24

## *How to take this course.*

1. Download and Print the test questions.
2. Login to your account with your ID and password.
3. Viewing your status page, scroll down and click on "[Click here to start this course](#)".
4. Begin viewing the web pages. Refer to your printed test to find the correct answers. The questions track the web pages.
5. As you find the answers, circle them on your printed copy.
6. At the end of each section, you'll enter the quiz which is the same as your printed test. Refer to your circled answers when actually answering the quiz on the web.
7. Upon passing, you will proceed to the next section. If failed to pass, you will be moved to the beginning of that section for more review.

## *Information that you will need in this course and on the job*



# Water Wells Fundamentals Part 2- Bold Copy

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Water Storage Tank Size				
Recommended Minimum Storage (Gallons)				
Well Yield (gpm)	Number of Bedrooms			
	2	3	4	5
More than 5	None			
3 to 5	100	150	200	250
1 to 2.9	150	200	250	300
0.5 to 0.9	200	250		
Less than 0.5	Not recommended for use			

## Jet Pump Motor Data and Electrical Components

### A.O. SMITH MOTOR DATA

GP Number	Where Used	A.O. Smith	HP	Volts	Phase	Service Factor	Max. Load Amps	Watts	Circuit Breaker
J04853	J05, HB705	C48J2DB11C3HF	½	115/230	1	1.6	10.8/5.4	880	25/15
J05853	JL07N, HSJ07, XSH07, HB	C48K2DB11A4HH	¾	115/230	1	1.5	14.8/7.4	1280	30/15
J06853	JL10N, HSJ10, SJ10, XSH10, HB	C48L2DB11A4HH	1	115/230	1	1.4	16.2/8.1	1440	30/20
J07858	HSJ15, SJ15, HB, XSH15	C48M2DB11A1HH	1½	115/230	1	1.3	20.0/10.0	1866	40/20
J08854	HSJ20, HSC20, XSH20	K48N2DB11A2HH	2	115/230	1	1.2	22.6/11.3	2100	25/15
J09853	XSH30, GT30	C56P2U11A3HH	3	230	1	1.15	17.2	3280	30
J04853L	J5/SI, GB	C48A93A06	½	115/230	1	1.6	10.8/5.4	968	25/15

PE Pipe Head Losses (ft H <sub>2</sub> O/100 ft pipe)												
Volume Flow		Nominal Pipe Diameter (inches)										
Gallons Per Minute)	Gallons Per Hour	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	6
		Nominal Inside Diameter (inches)										
		0.493	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026	6.065
1	60	3.3	1.1	0.3								
2	120	11.8	3.8	1.0	0.3	0.1						
4	240	42.5	13.7	3.5	1.1	0.3	0.1					
5	300	64.2	20.7	5.3	1.6	0.4	0.2					
6	360		29.0	7.4	2.3	0.6	0.3					
8	480		49.5	12.6	3.9	1.0	0.5	0.1				
10	600		74.7	19.0	5.9	1.6	0.7	0.2	0.1			
20	1200			68.6	21.2	5.6	2.6	0.8	0.3	0.1		
30	1800					11.8	5.6	1.7	0.7	0.2		
40	2400					20.1	9.5	2.8	1.2	0.4	0.1	
50	3000						14.4	4.3	1.8	0.6	0.2	
60	3600						20.1	6.0	2.5	0.9	0.2	
70	4200							7.9	3.3	1.2	0.3	
80	4800							10.2	4.3	1.5	0.4	
90	5400							12.6	5.3	1.9	0.5	
100	6000								6.5	2.3	0.6	0.1
125	7500								9.8	3.4	0.9	0.1
150	9000									4.8	1.3	0.2

### EQUIVALENT NUMBER OF FEET STRAIGHT PIPE FOR DIFFERENT FITTINGS

Size of fittings, Inches	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"	8"	10"
90° Ell	1.5	2.0	2.7	3.5	4.3	5.5	6.5	8.0	10.0	14.0	15	20	25
45° Ell	0.8	1.0	1.3	1.7	2.0	2.5	3.0	3.8	5.0	6.3	7.1	9.4	12
Long Sweep Ell	1.0	1.4	1.7	2.3	2.7	3.5	4.2	5.2	7.0	9.0	11.0	14.0	
Close Return Bend	3.6	5.0	6.0	8.3	10.0	13.0	15.0	18.0	24.0	31.0	37.0	39.0	
Tee-Straight Run	1	2	2	3	3	4	5						
Tee-Side Inlet or Outlet or Pitless Adapter	3.3	4.5	5.7	7.6	9.0	12.0	14.0	17.0	22.0	27.0	31.0	40.0	
① Ball or Globe Valve Open	17.0	22.0	27.0	36.0	43.0	55.0	67.0	82.0	110.0	140.0	160.0	220.0	
① Angle Valve Open	8.4	12.0	15.0	18.0	22.0	28.0	33.0	42.0	58.0	70.0	83.0	110.0	
Gate Valve-Fully Open	0.4	0.5	0.6	0.8	1.0	1.2	1.4	1.7	2.3	2.9	3.5	4.5	
Check Valve (Swing)	4	5	7	9	11	13	16	20	26	33	39	52	65
In Line Check Valve (Spring) or Foot Valve	4	6	8	12	14	19	23	32	43	58			

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PE Pipe Head Losses (ft H <sub>2</sub> O/100 ft pipe)												
Volume Flow		Nominal Pipe Diameter (inches)										
Gallons Per Minute)	Gallons Per Hour	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	6
		Nominal Inside Diameter (inches)										
		0.493	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026	6.065
1	60	3.3	1.1	0.3								
2	120	11.8	3.8	1.0	0.3	0.1						
4	240	42.5	13.7	3.5	1.1	0.3	0.1					
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8	480		49.5	12.6	3.9	1.0	0.5	0.1				
10	600		74.7	19.0	5.9	1.6	0.7	0.2	0.1			
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50	3000						14.4	4.3	1.8	0.6	0.2	
60	3600						20.1	6.0	2.5	0.9	0.2	
70	4200							7.9	3.3	1.2	0.3	
80	4800							10.2	4.3	1.5	0.4	
90	5400							12.6	5.3	1.9	0.5	
100	6000								6.5	2.3	0.6	0.1
125	7500								9.8	3.4	0.9	0.1
150	9000									4.8	1.3	0.2

### Quiz 1 – Lesson 1

- Removal of water from a well at a rate faster than the recharge or recovery rate will result in \_\_\_\_\_.
  - a dry well
  - over-heated pump motor
  - burnt out pump motor
  - All of the answers provided
  - None of the answers provided
- Which of the following is not a standard well pump?
  - Shallow well jet pump
  - Deep well jet pump
  - Submersible pump
  - Deep well submersible jet pump
- A shallow well jet pump has a/n \_\_\_\_\_.
  - impeller
  - diffuser
  - matched nozzle and venture
  - all of the answers provided
- A venturi increases water velocity and \_\_\_\_\_ surrounding water pressure.
  - decreases
  - increases
- equalizes
- multiplies
- none of the answers provided
- This \_\_\_\_\_ pressure drags water from the surrounding area as it moves through the pipe.
  - decreased
  - increased
  - equalized
  - multiplied
  - none of the answers provided
- A shallow well jet pump has all these parts except the \_\_\_\_\_.
  - diffuser
  - nozzle
  - electric motor
  - impeller
  - balancing valve
- A jet nozzle and venturi combination is also known as a/n \_\_\_\_\_.
  - rejecter
  - ejector or ejector kit
  - subjector

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- digester
  - none of the answers provided
8. A jet nozzle/venturi and centrifugal pump can increase its lift from \_\_\_\_\_ to \_\_\_\_\_.
- 1 feet – 8 feet
  - 20 feet – 25 feet
  - 15 feet – 20 feet
  - 28 feet – 48 feet
  - none of the answers provided
9. A deep well jet pump is also known as a \_\_\_\_\_ system.
- 1 pipe
  - 2 pipe
  - 3 pipe
  - hot pipe
  - cold pipe
10. The venturi of a deep well jet pump is located \_\_\_\_\_.
- at the inlet of the storage tank
  - at the inlet of the pressure tank
  - inside the pump housing
  - at the bottom of the well above the foot valve
  - none of the answers provided
11. Typically, the maximum lift of a deep well jet pump is \_\_\_\_\_.
- 20 feet
  - 28 feet
  - 50 feet
  - 100 feet
  - 300 feet
12. The pipes on a deep well jet pump are \_\_\_\_\_ and \_\_\_\_\_ pipes.
- suction – pressure
  - hot – cold
  - supply – return
  - foot – hand
  - left hand – right hand
13. The major difference between a shallow well jet pump and a deep well jet pump is \_\_\_\_\_.
- the size of the motor
  - the size of the ejector
  - the location of the ejector
  - the gpm that can be pumped
  - none of the answers provided
14. A shallow well jet pump can be used to a maximum lift of \_\_\_\_\_.
- 25 feet
  - 50 feet
  - 75 feet
  - 100 feet

- greater than 100 feet

---

## Quiz 2 – Lesson 2

1. A submersible deep well pump can be used to a depth of \_\_\_\_\_.
- 25 feet
  - 50 feet
  - 75 feet
  - 100 feet
  - greater than 100 feet
2. A centrifugal pump discharges high pressure liquid into a \_\_\_\_\_.
- basket
  - receiver
  - catch basin
  - discharge pan
  - none of the answers provided
3. The center or the eye of the vortex is \_\_\_\_\_ pressure.
- low
  - high
  - neutral
  - equal
  - none of the answers provided
4. The eye \_\_\_\_\_ the supply water.
- pulls in
  - pushes out
  - freezes
  - boils
  - none of the answers provided
5. The 2 main parts of a centrifugal motor are \_\_\_\_\_ and the \_\_\_\_\_.
- diffuser – receiver
  - on switch – off switch
  - impeller – repeller
  - impeller – diffuser
  - none of the answers provided
6. Shaft speeds can reach \_\_\_\_\_.
- 36 rpm
  - 360 rpm
  - 3600 rpm (nominal speed)
  - 36000 rpm
7. Multiple configurations of impellers/diffusers are called \_\_\_\_\_.
- stages
  - sets
  - units
  - combos
  - none of the answers provided

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8. Increasing the multiple configurations of impellers/diffusers \_\_\_\_\_ system pressure and capacity.
  - decreases
  - increases
  - equalizes
  - divides
  - none of the answers provided
9. Most submersible pumps conform to NEMA standards for \_\_\_\_\_ diameters.
  - 4 inch
  - 6 inch
  - 8 inch
  - all of the answers provided
  - none of the answers provided
10. On the pump curve as shown on the last page of this chapter, the submersible pump at a Total Dynamic Head of 500 feet would yield about \_\_\_\_\_.
  - 10 gpm
  - 15 gpm
  - 20 gpm
  - 25 gpm
  - none of the answers provided

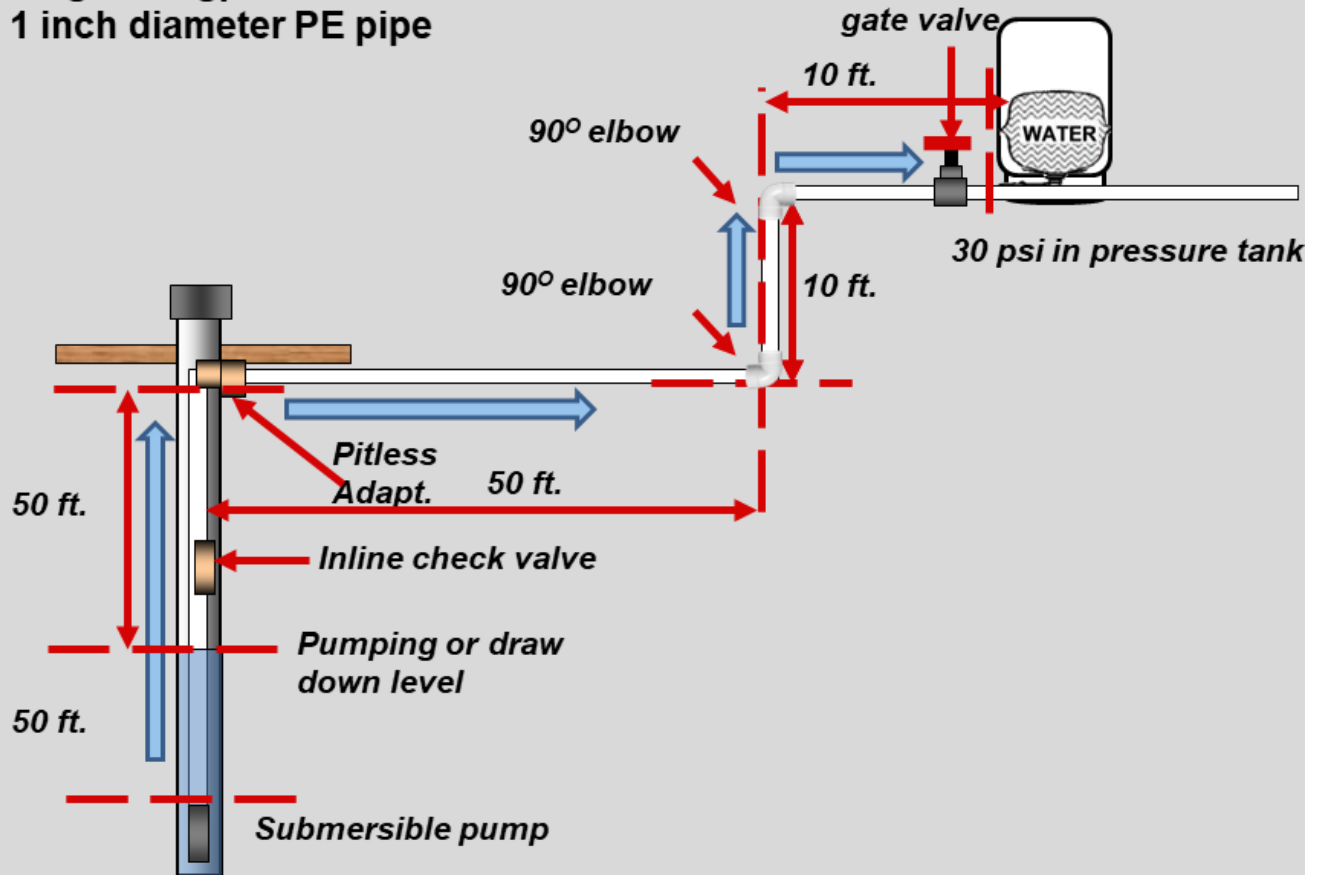
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### Quiz 3 –Lesson 3

1. A well pump must be sized to not exceed the well recovery rate because \_\_\_\_\_.
  - of the additional cost of the pump
  - of increased electrical components
  - a dry well may result
  - it will encourage waste
  - none of the answers provided
2. Wells that are deeper than 100 feet must use a \_\_\_\_\_.
  - shallow well jet pump
  - deep well jet pump
  - submersible pump
  - transaxle pump
3. Elevation head is the \_\_\_\_\_ distance which the water must be pumped.
  - vertical
  - horizontal
  - maximum
  - minimum
  - none of the answers provided
  -
4. In sizing a pump for a system, the first step is to determine the \_\_\_\_\_.
  - elevation head loss
  - friction loss from the pipe
  - friction loss from the fittings
  - pressure head
5. In sizing a pump for a system, the second step is to determine the \_\_\_\_\_.
  - elevation head
  - friction loss from the pipe length (measure the total length of pipe)
  - friction loss from the fittings
  - pressure head
6. In sizing a pump for a system, the third step is to determine the \_\_\_\_\_.
  - elevation head
  - friction loss from the pipe
  - friction loss from the fittings
  - pressure tank head loss
7. In sizing a pump for a system, the fourth step is to determine the \_\_\_\_\_.
  - elevation head
  - friction loss from the pipe
  - friction loss from the fittings
  - pressure tank head loss

## Quiz 3

**Target: 8 gpm**  
**1 inch diameter PE pipe**



8. As shown in Quiz 3 Illustration, the elevation head is \_\_\_\_\_. (Note: Only vertical lift is from the drawdown level to the Pitless Adapter)
- 50 feet
  - 100 feet
  - 120 feet
  - 170 feet
  - 240 feet

9. Total length of straight pipe is \_\_\_\_\_.
- 100 feet
  - 120 feet
  - 170 feet
  - 240 feet
  - 275 feet

### EQUIVALENT NUMBER OF FEET STRAIGHT PIPE FOR DIFFERENT FITTINGS

Size of fittings, Inches	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"	8"	10"
90° Ell	1.5	2.0	2.7	3.5	4.3	5.5	6.5	8.0	10.0	14.0	15	20	25
45° Ell	0.8	1.0	1.3	1.7	2.0	2.5	3.0	3.8	5.0	6.3	7.1	9.4	12
Long Sweep Ell	1.0	1.4	1.7	2.3	2.7	3.5	4.2	5.2	7.0	9.0	11.0	14.0	
Close Return Bend	3.6	5.0	6.0	8.3	10.0	13.0	15.0	18.0	24.0	31.0	37.0	39.0	
Tee-Straight Run	1	2	2	3	3	4	5						
Tee-Side Inlet or Outlet or Pitless Adapter	3.3	4.5	5.7	7.6	9.0	12.0	14.0	17.0	22.0	27.0	31.0	40.0	
① Ball or Globe Valve Open	17.0	22.0	27.0	36.0	43.0	55.0	67.0	82.0	110.0	140.0	160.0	220.0	
① Angle Valve Open	8.4	12.0	15.0	18.0	22.0	28.0	33.0	42.0	58.0	70.0	83.0	110.0	
Gate Valve-Fully Open	0.4	0.5	0.6	0.8	1.0	1.2	1.4	1.7	2.3	2.9	3.5	4.5	
Check Valve (Swing)	4	5	7	9	11	13	16	20	26	33	39	52	65
In Line Check Valve (Spring) or Foot Valve	4	6	8	12	14	19	23	32	43	58			

**PE Pipe Head Losses (ft H<sub>2</sub>O/100 ft pipe)**

Volume Flow		Nominal Pipe Diameter (inches)										
Gallons Per Minute)	Gallons Per Hour	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	6
		Nominal Inside Diameter (inches)										
		0.493	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026	6.065
1	60	3.3	1.1	0.3								
2	120	11.8	3.8	1.0	0.3	0.1						
4	240	42.5	13.7	3.5	1.1	0.3	0.1					
5	300	64.2	20.7	5.3	1.6	0.4	0.2					
6	360		29.0	7.4	2.3	0.6	0.3					
8	480		49.5	12.6	3.9	1.0	0.5	0.1				
10	600		74.7	19.0	5.9	1.6	0.7	0.2	0.1			
20	1200			68.6	21.2	5.6	2.6	0.8	0.3	0.1		
30	1800					11.8	5.6	1.7	0.7	0.2		
40	2400					20.1	9.5	2.8	1.2	0.4	0.1	
50	3000						14.4	4.3	1.8	0.6	0.2	
60	3600						20.1	6.0	2.5	0.9	0.2	
70	4200							7.9	3.3	1.2	0.3	
80	4800							10.2	4.3	1.5	0.4	
90	5400							12.6	5.3	1.9	0.5	
100	6000								6.5	2.3	0.6	0.1
125	7500								9.8	3.4	0.9	0.1
150	9000									4.8	1.3	0.2

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10. Pipe fitting losses – Equivalent length of pipe is \_\_\_\_\_ (use inline check valve spring and round up to nearest full foot). (See Table: Equivalent Number of Feet Straight Pipe for Different Fittings).

- 9 feet
- 20 feet
- 29 feet
- 35 feet
- 42 feet

11. Total equivalent length of pipe from pipe length and pipe fittings is \_\_\_\_\_. (round up to the nearest foot)

- 97 feet
- 164 feet
- 190 feet
- 211 feet
- 314 feet

12. Pipe head losses per 100 feet of equivalent pipe is \_\_\_\_\_.

- 49.5 feet
- 12.6 feet
- 3.9 feet
- 1.0 feet
- 0.5 feet

13. Pipe head losses for pipe section is \_\_\_\_\_. (round up to nearest full foot).

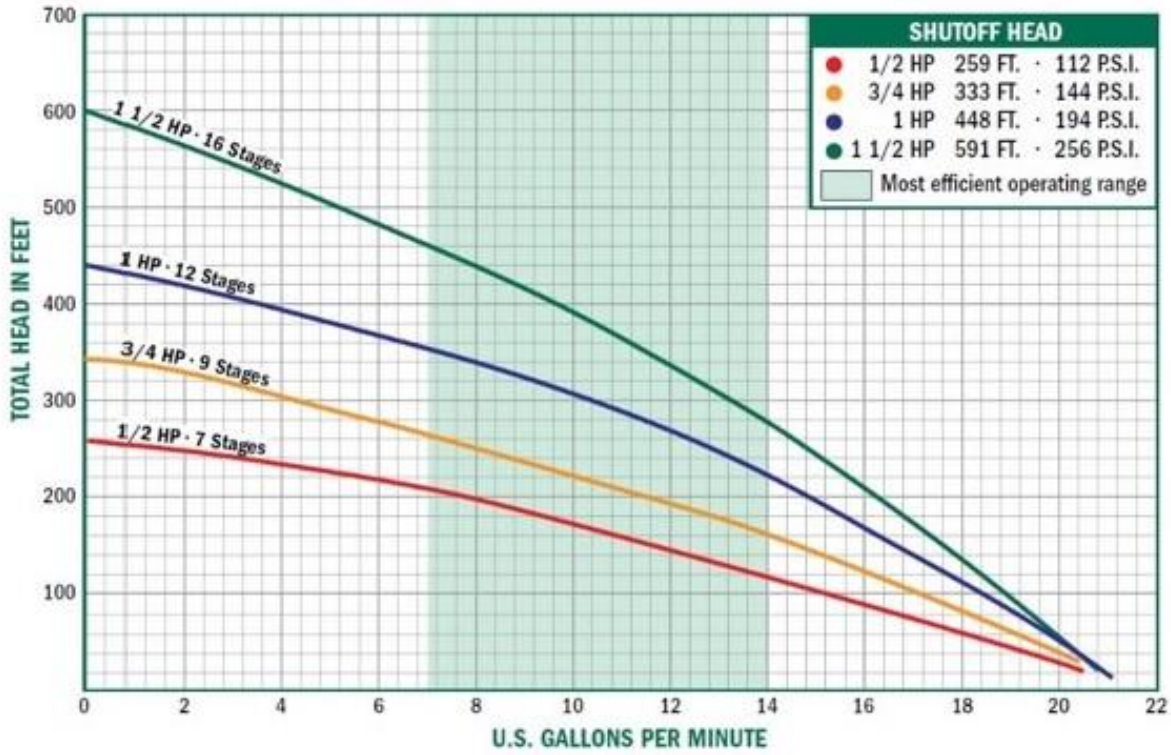
- 5 feet
- 8 feet
- 16 feet
- 24 feet
- 91 feet

14. Head loss on pressure tank – (psi x 2.31) = \_\_\_\_\_ (Round up to nearest full foot).

- 47 feet
- 70 feet
- 93 feet
- 116 feet
- 139 feet
- 

15. Total dynamic head is \_\_\_\_\_. (Round up nearest full foot) (Hint: 3 types of losses)

- 27 feet
- 128 feet
- 214 feet
- 294 feet
- 315 feet
-



Lesson 4

16. The “best fit” pump to deliver the minimum demand of 8 gpm is a \_\_\_\_\_.

- 1/2 hp.
- 3/4 hp.
- 1 hp.
- 1-1/2 hp.
- none on chart

17. This “best fit” pump is expected to deliver about \_\_\_\_\_.

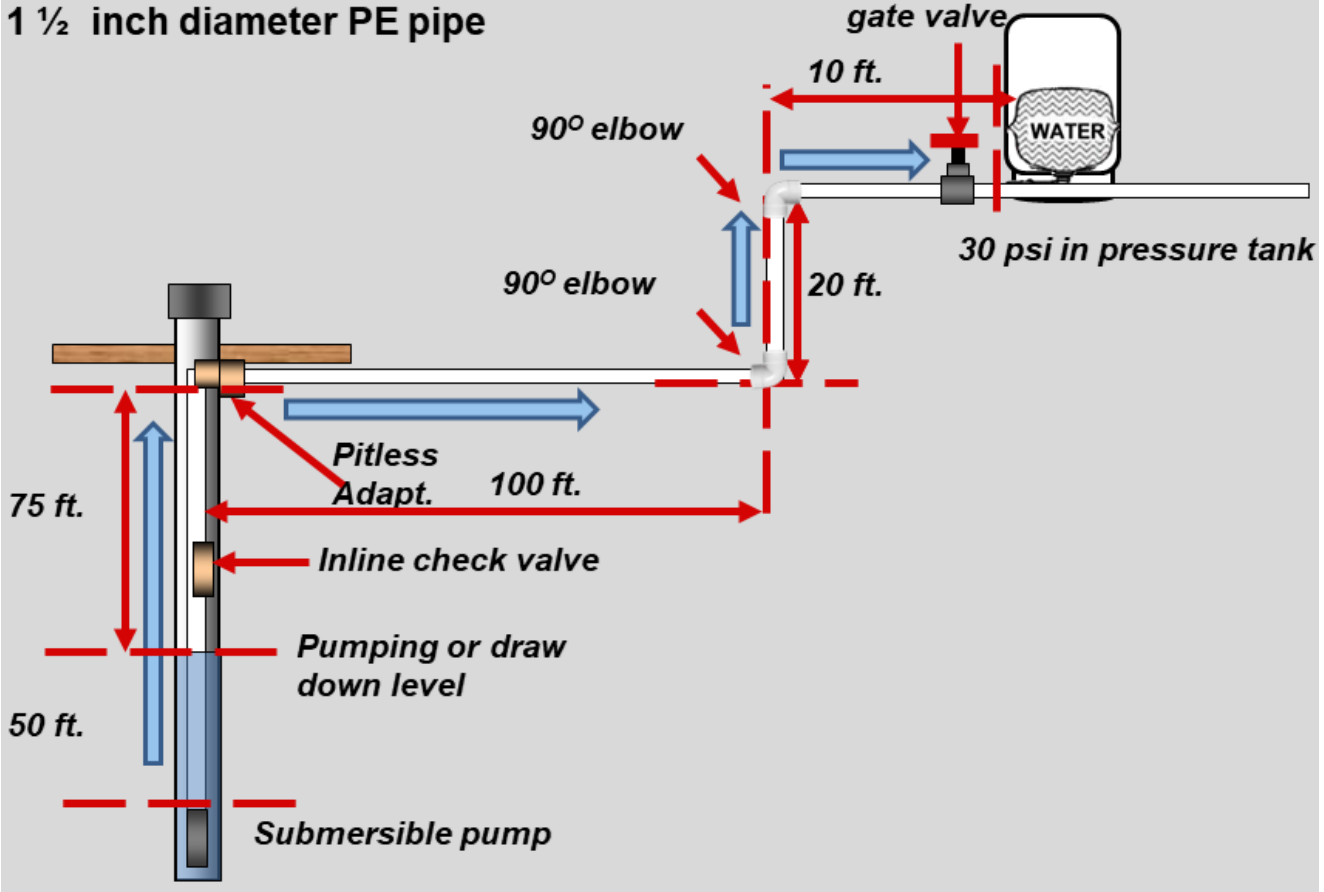
- 1 gpm
- 2 gpm
- 5 gpm
- 13 gpm
- 19 gpm



Quiz 4 – Chapter 7

**Quiz 4**

**Target: 10 gpm**  
**1 1/2 inch diameter PE pipe**



1. The elevation head is \_\_\_\_\_. (Note: Only vertical lift is from drawdown level to Pitless adapter)
  - 75 feet
  - 120 feet
  - 145 feet
  - 170 feet
  - 240 feet
  
2. Total length of straight pipe is \_\_\_\_\_.
  - 75 feet
  - 105 feet
  - 190 feet
  - 255 feet
  - 285 feet

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## EQUIVALENT NUMBER OF FEET STRAIGHT PIPE FOR DIFFERENT FITTINGS

Size of fittings, Inches	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"	8"	10"
90° Ell	1.5	2.0	2.7	3.5	4.3	5.5	6.5	8.0	10.0	14.0	15	20	25
45° Ell	0.8	1.0	1.3	1.7	2.0	2.5	3.0	3.8	5.0	6.3	7.1	9.4	12
Long Sweep Ell	1.0	1.4	1.7	2.3	2.7	3.5	4.2	5.2	7.0	9.0	11.0	14.0	
Close Return Bend	3.6	5.0	6.0	8.3	10.0	13.0	15.0	18.0	24.0	31.0	37.0	39.0	
Tee-Straight Run	1	2	2	3	3	4	5						
Tee-Side Inlet or Outlet or Pitless Adapter	3.3	4.5	5.7	7.6	9.0	12.0	14.0	17.0	22.0	27.0	31.0	40.0	
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Gate Valve-Fully Open	0.4	0.5	0.6	0.8	1.0	1.2	1.4	1.7	2.3	2.9	3.5	4.5	
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In Line Check Valve (Spring) or Foot Valve	4	6	8	12	14	19	23	32	43	58			

3. Pipe fitting losses – Equivalent length of pipe is \_\_\_\_\_ (use inline check valve- spring and round to nearest full foot. ) (See Table: Equivalent Number of Feet Straight Pipe for Different Fittings).

- 4 feet
- 17 feet
- 21 feet
- 33 feet
- 391 feet

4. Total equivalent length of pipe friction loss from pipe length and pipe fittings is \_\_\_\_\_. (nearest foot)

- 107 feet
- 174 feet
- 198 feet
- 211 feet
- 288 feet

5. Pressure loss per 100 feet of equivalent pipe is \_\_\_\_\_. (Hint – Use the 10 gpm row @ 1 ½" dia pipe)

- 74.7 feet
- 19.0 feet
- 5.9 feet
- 1.6 feet
- 0.7 feet

6. Friction head loss from pipe is \_\_\_\_\_ (to nearest full foot).

- 2 feet
- 14 feet
- 16 feet
- 31 feet
- 87 feet

PE Pipe Head Losses (ft H <sub>2</sub> O/100 ft pipe)												
Volume Flow		Nominal Pipe Diameter (inches)										
Gallons Per Minute <sup>a</sup>	Gallons Per Hour	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	6
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6	360		29.0	7.4	2.3	0.6	0.3					
8	480		49.5	12.6	3.9	1.0	0.5	0.1				
10	600		74.7	19.0	5.9	1.6	0.7	0.2	0.1			
20	1200			68.6	21.2	5.6	2.6	0.8	0.3	0.1		
30	1800					11.8	5.6	1.7	0.7	0.2		
40	2400					20.1	9.5	2.8	1.2	0.4	0.1	
50	3000						14.4	4.3	1.8	0.6	0.2	
60	3600						20.1	6.0	2.5	0.9	0.2	
70	4200							7.9	3.3	1.2	0.3	
80	4800							10.2	4.3	1.5	0.4	
90	5400							12.6	5.3	1.9	0.5	
100	6000								6.5	2.3	0.6	0.1
125	7500								9.8	3.4	0.9	0.1
150	9000									4.8	1.3	0.2

# Water Wells Fundamentals Part 2- Bold Copy

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7. Head loss on pressure tank – (psi x 2.31) = \_\_\_\_\_ (round up to nearest full foot).

- 47 feet
- 70 feet
- 93 feet
- 116 feet
- 139 feet

8. Total dynamic head is \_\_\_\_\_ (to nearest full foot). (Hint: 3 types of losses)

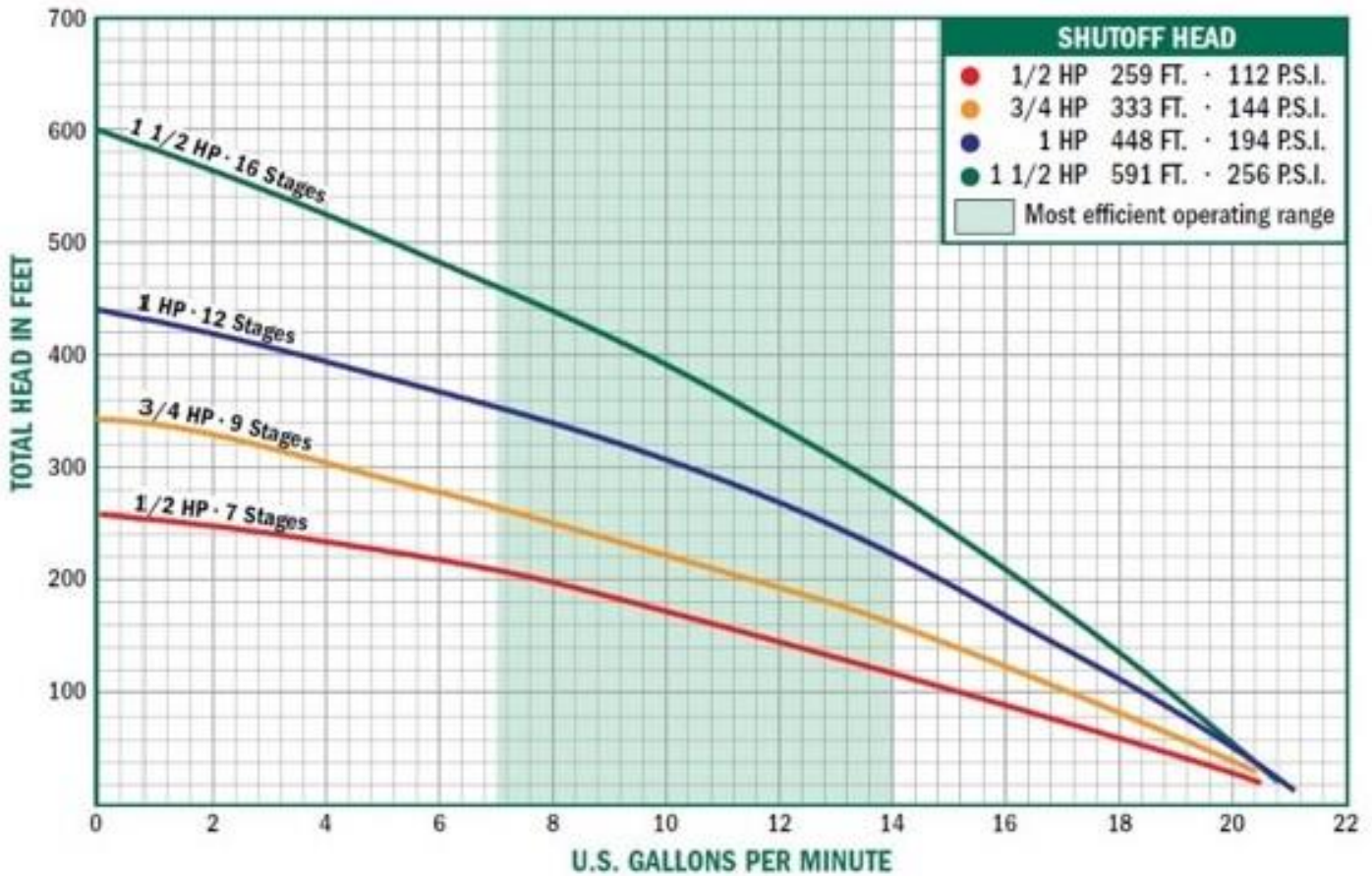
- 147 feet
- 191 feet
- 224 feet
- 319 feet
- 391 feet

9. The “best fit” pump to deliver the minimum demand gpm is a \_\_\_\_\_. (See pump curves on page 5)

- 1/2 hp.
- 3/4 hp.
- 1 hp.
- 1-1/2 hp.
- Requires a larger pump than shown on the on chart

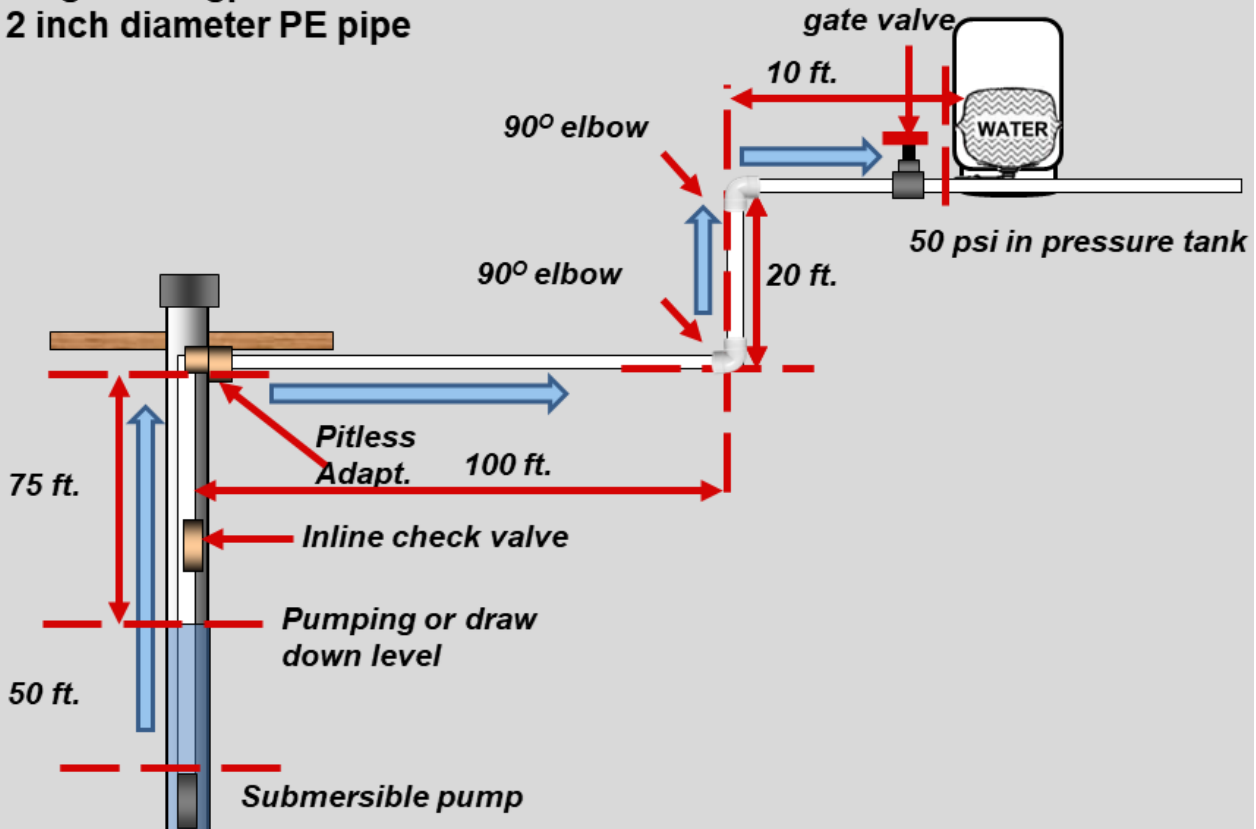
10. This “best fit” pump is expected to deliver about \_\_\_\_\_.

- 4 gpm
- 6 gpm
- 12 gpm
- 15 gpm
- Requires a larger pump than shown on the on chart



## Quiz 5

**Target: 20 gpm  
2 inch diameter PE pipe**



- The elevation head is \_\_\_\_\_. (Note: Only vertical lift is from drawdown level to Pitless adapter)
  - 75 feet
  - 120 feet
  - 170 feet
  - 250 feet
  - 375 feet
- Total length of straight pipe is \_\_\_\_\_.
  - 105 feet
- Pipe fitting losses ; Equivalent length of pipe is \_\_\_\_\_ (Use inline check valve – spring and round up to nearest full foot). (See Table: Equivalent Number of Feet Straight Pipe for Different Fittings).
  - 125 feet
  - 175 feet
  - 190 feet
  - 255 feet

### EQUIVALENT NUMBER OF FEET STRAIGHT PIPE FOR DIFFERENT FITTINGS

Size of fittings, Inches	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"	8"	10"
90° Ell	1.5	2.0	2.7	3.5	4.3	5.5	6.5	8.0	10.0	14.0	15	20	25
45° Ell	0.8	1.0	1.3	1.7	2.0	2.5	3.0	3.8	5.0	6.3	7.1	9.4	12
Long Sweep Ell	1.0	1.4	1.7	2.3	2.7	3.5	4.2	5.2	7.0	9.0	11.0	14.0	
Close Return Bend	3.6	5.0	6.0	8.3	10.0	13.0	15.0	18.0	24.0	31.0	37.0	39.0	
Tee-Straight Run	1	2	2	3	3	4	5						
Tee-Side Inlet or Outlet or Pitless Adapter	3.3	4.5	5.7	7.6	9.0	12.0	14.0	17.0	22.0	27.0	31.0	40.0	
① Ball or Globe Valve Open	17.0	22.0	27.0	36.0	43.0	55.0	67.0	82.0	110.0	140.0	160.0	220.0	
① Angle Valve Open	8.4	12.0	15.0	18.0	22.0	28.0	33.0	42.0	58.0	70.0	83.0	110.0	
Gate Valve-Fully Open	0.4	0.5	0.6	0.8	1.0	1.2	1.4	1.7	2.3	2.9	3.5	4.5	
Check Valve (Swing)	4	5	7	9	11	13	16	20	26	33	39	52	65
In Line Check Valve (Spring) or Foot Valve	4	6	8	12	14	19	23	32	43	58			

# Water Wells Fundamentals Part 2- Bold Copy

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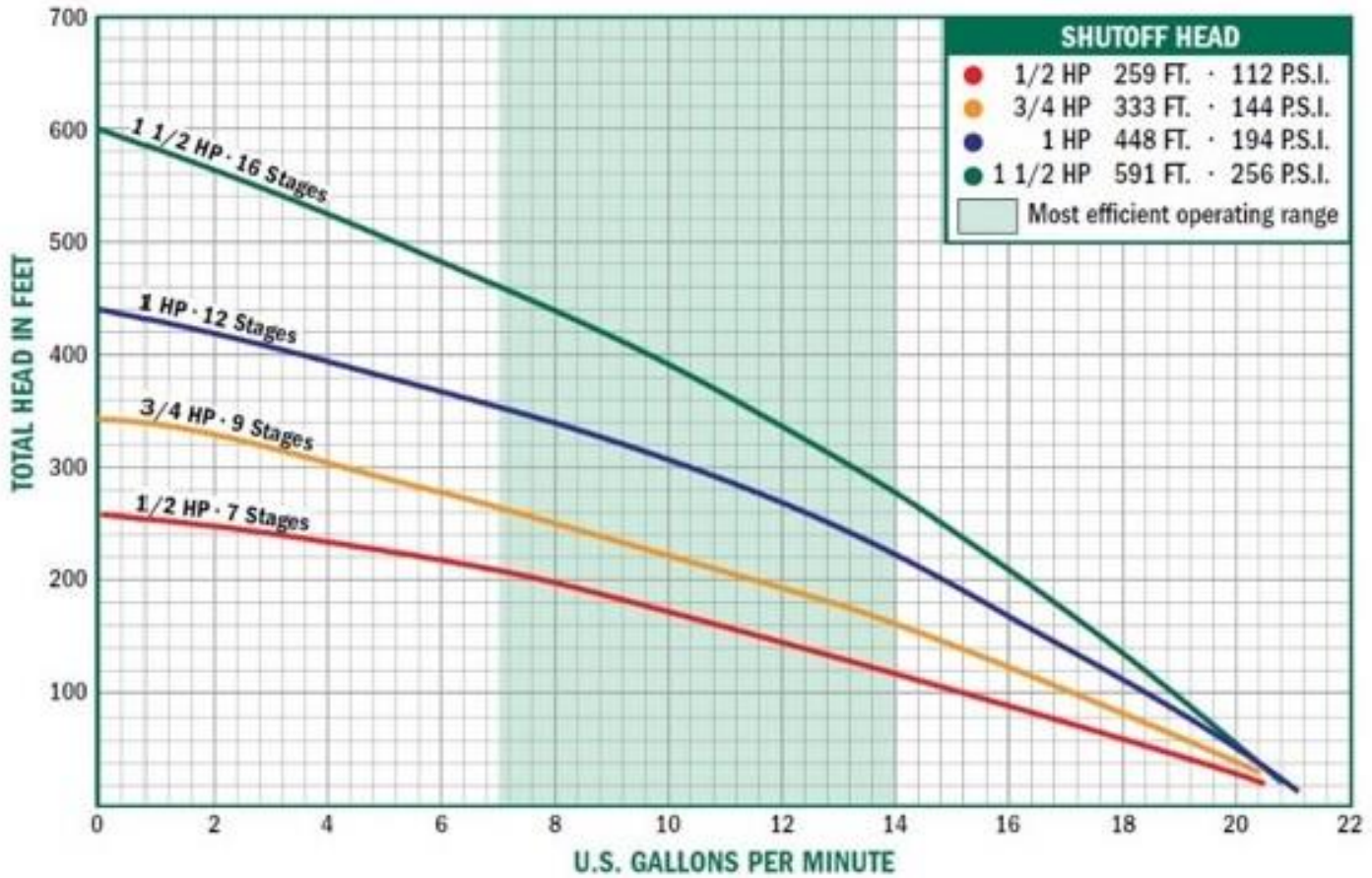
- 9 feet
  - 17 feet
  - 25 feet
  - 32 feet
  - 44 feet
4. Total equivalent length of pipe friction loss from pipe length and pipe fittings is \_\_\_\_\_.(nearest foot)
- 93 feet
  - 154 feet
  - 179 feet
  - 299 feet
  - 484 feet
- 116 feet
  - 139 feet
8. Total head loss is \_\_\_\_\_ (to nearest full foot).(Hint: 3 types of losses)
- 27 feet
  - 97 feet
  - 114 feet
  - 194 feet
  - 315 feet

PE Pipe Head Losses (ft H <sub>2</sub> O/100 ft pipe)												
Volume Flow		Nominal Pipe Diameter (inches)										
Gallons Per Minute)	Gallons Per Hour	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	6
		Nominal Inside Diameter (inches)										
		0.493	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026	6.065
1	60	3.3	1.1	0.3								
2	120	11.8	3.8	1.0	0.3	0.1						
4	240	42.5	13.7	3.5	1.1	0.3	0.1					
5	300	64.2	20.7	5.3	1.6	0.4	0.2					
6	360		29.0	7.4	2.3	0.6	0.3					
8	480		49.5	12.6	3.9	1.0	0.5	0.1				
10	600		74.7	19.0	5.9	1.6	0.7	0.2	0.1			
20	1200			68.6	21.2	5.6	2.6	0.8	0.3	0.1		
30	1800					11.8	5.6	1.7	0.7	0.2		
40	2400					20.1	9.5	2.8	1.2	0.4	0.1	
50	3000						14.4	4.3	1.8	0.6	0.2	
60	3600						20.1	6.0	2.5	0.9	0.2	
70	4200							7.9	3.3	1.2	0.3	
80	4800							10.2	4.3	1.5	0.4	
90	5400							12.6	5.3	1.9	0.5	
100	6000								6.5	2.3	0.6	0.1
125	7500								9.8	3.4	0.9	0.1
150	9000									4.8	1.3	0.2

5. Pressure loss per 100 feet of equivalent pipe is \_\_\_\_\_.
- 68.6 feet
  - 21.2 feet
  - 5.6 feet
  - 2.6 feet
  - 0.8 feet
6. Head loss from pipe is \_\_\_\_\_ (Round up to nearest full foot, use inline check valve).
- 3 feet
  - 5 feet
  - 9 feet
  - 16 feet
  - 24 feet
7. Head loss on pressure tank – (psi x 2.31) = \_\_\_\_\_ (Round up to nearest full foot).
- 47 feet
  - 69 feet
  - 93 feet

# Water Wells Fundamentals Part 2- Bold Copy

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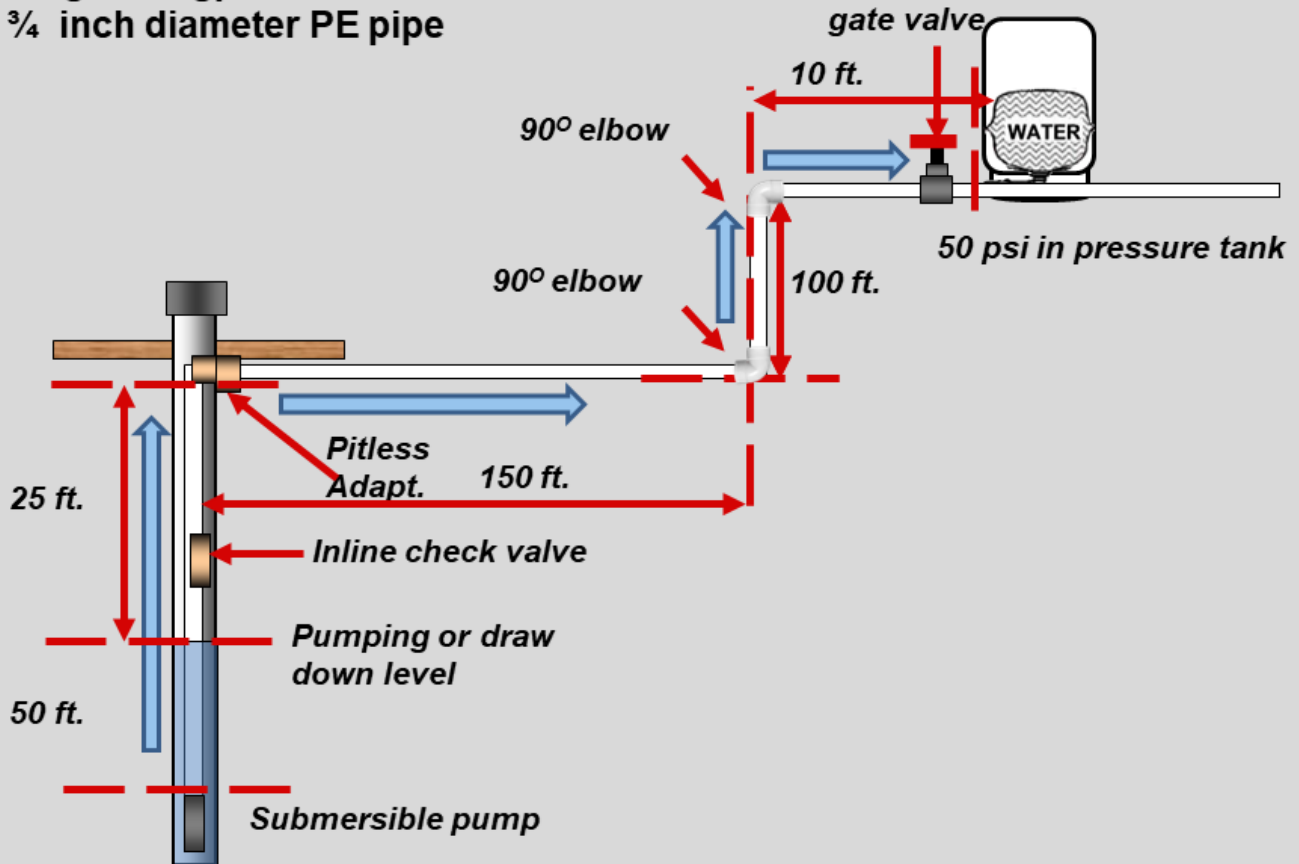


9. The “best fit” pump to deliver the minimum demand gpm is a \_\_\_\_\_.
- 1/2 hp.
  - 3/4 hp.
  - 1 hp.
  - 1-1/2 hp.
  - Requires a larger pump than shown on the chart

10. This “best fit” pump is expected to deliver about \_\_\_\_\_.
- 6 gpm
  - 8 gpm
  - 10 gpm
  - 12 gpm
  - Requires a larger pump than shown on the chart

## Quiz 6

**Target: 4 gpm**  
**3/4 inch diameter PE pipe**



1. The elevation head is \_\_\_\_\_. (Note: Only vertical lift is from drawdown level to Pitless Adapter)

- 25 feet
- 125 feet
- 170 feet
- 240 feet
- 275 feet

2. Total length of straight pipe is \_\_\_\_\_.

- 100 feet
- 120 feet
- 170 feet
- 240 feet
- 335 feet

# Water Wells Fundamentals Part 2- Bold Copy

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## EQUIVALENT NUMBER OF FEET STRAIGHT PIPE FOR DIFFERENT FITTINGS

Size of fittings, Inches	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"	8"	10"
90° Ell	1.5	2.0	2.7	3.5	4.3	5.5	6.5	8.0	10.0	14.0	15	20	25
45° Ell	0.8	1.0	1.3	1.7	2.0	2.5	3.0	3.8	5.0	6.3	7.1	9.4	12
Long Sweep Ell	1.0	1.4	1.7	2.3	2.7	3.5	4.2	5.2	7.0	9.0	11.0	14.0	
Close Return Bend	3.6	5.0	6.0	8.3	10.0	13.0	15.0	18.0	24.0	31.0	37.0	39.0	
Tee-Straight Run	1	2	2	3	3	4	5						
Tee-Side Inlet or Outlet or Pitless Adapter	3.3	4.5	5.7	7.6	9.0	12.0	14.0	17.0	22.0	27.0	31.0	40.0	
① Ball or Globe Valve Open	17.0	22.0	27.0	36.0	43.0	55.0	67.0	82.0	110.0	140.0	160.0	220.0	
① Angle Valve Open	8.4	12.0	15.0	18.0	22.0	28.0	33.0	42.0	58.0	70.0	83.0	110.0	
Gate Valve-Fully Open	0.4	0.5	0.6	0.8	1.0	1.2	1.4	1.7	2.3	2.9	3.5	4.5	
Check Valve (Swing)	4	5	7	9	11	13	16	20	26	33	39	52	65
In Line Check Valve (Spring) or Foot Valve	4	6	8	12	14	19	23	32	43	58			

3. Pipe fitting losses – Equivalent length of pipe is \_\_\_\_\_ (Use inline check valve and round up to nearest full foot). (See Table: Equivalent Number of Feet Straight Pipe for Different Fittings).

- 9 feet
- 15 feet
- 22 feet
- 27 feet
- 31 feet

4. Total length of pipe from both the pipe length and the pipe fittings is \_\_\_\_\_. (Round up to nearest full foot)

- 97 feet
- 164 feet
- 189 feet
- 211 feet

- 350 feet

5. Pressure loss per 100 feet of equivalent pipe is \_\_\_\_\_. (Hint: Use ¾" column)

- 42.5 feet
- 13.7 feet
- 3.5 feet
- 1.1 feet
- 0.3 feet

6. Pipe friction head loss from pipe is \_\_\_\_\_ (Round up to nearest full foot).

- 7 feet
- 13 feet
- 16 feet
- 24 feet
- 91 feet

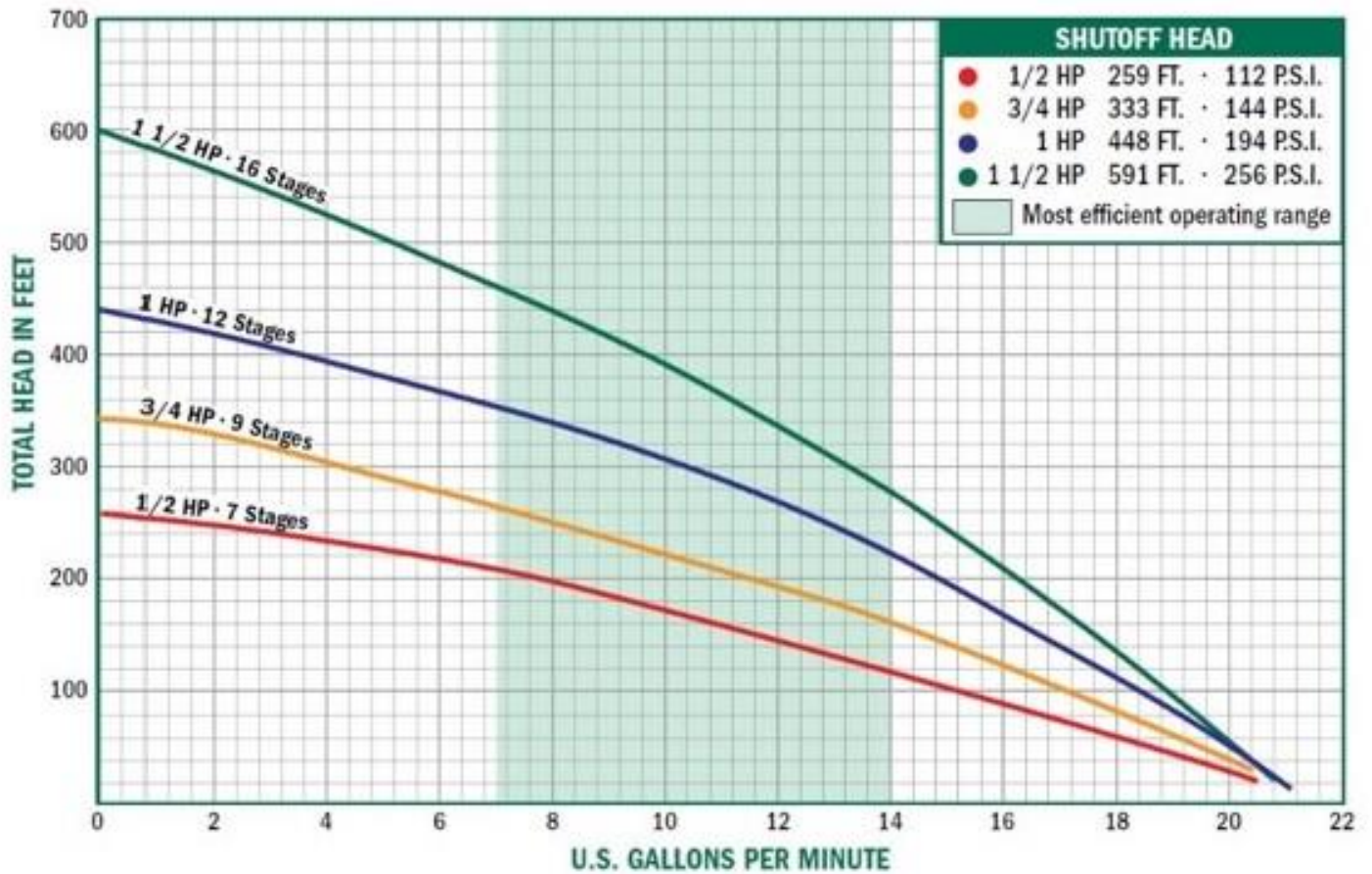
Volume Flow		PE Pipe Head Losses (ft H <sub>2</sub> O/100 ft pipe)											
Gallons Per Minute <sup>1</sup>	Gallons Per Hour	Nominal Pipe Diameter (inches)											
		3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	6	
		Nominal Inside Diameter (inches)											
		0.493	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026	6.065	
1	60	3.3	1.1	0.3									
2	120	11.8	3.8	1.0	0.3	0.1							
4	240	42.5	13.7	3.5	1.1	0.3	0.1						
5	300	64.2	20.7	5.3	1.6	0.4	0.2						
6	360		29.0	7.4	2.3	0.6	0.3						
8	480		49.5	12.6	3.9	1.0	0.5	0.1					
10	600		74.7	19.0	5.9	1.6	0.7	0.2	0.1				
20	1200			68.6	21.2	5.6	2.6	0.8	0.3	0.1			
30	1800					11.8	5.6	1.7	0.7	0.2			
40	2400					20.1	9.5	2.8	1.2	0.4	0.1		
50	3000						14.4	4.3	1.8	0.6	0.2		
60	3600						20.1	6.0	2.5	0.9	0.2		
70	4200							7.9	3.3	1.2	0.3		
80	4800							10.2	4.3	1.5	0.4		
90	5400							12.6	5.3	1.9	0.5		
100	6000								6.5	2.3	0.6	0.1	
125	7500								9.8	3.4	0.9	0.1	
150	9000									4.8	1.3	0.2	



# Water Wells Fundamentals Part 2- Bold Copy

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7. Pressure Tank Head loss on pressure tank – (psi x 2.31) = \_\_\_\_\_ (Round up to nearest full foot).
  - 47 feet
  - 69 feet
  - 93 feet
  - 116 feet
  - 139 feet
  
8. Total head loss is \_\_\_\_\_ (Round up to the nearest full foot).
  - 27 feet
  - 197 feet
  - 214 feet
  - 154 feet
  - 315 feet
  
9. The “best fit” pump to deliver the minimum demand gpm is a \_\_\_\_\_.
  - 1/2 hp.
  - 3/4 hp.
  - 1 hp.
  - 1-1/2 hp.
  - none on chart
  
10. This “best fit” pump is expected to deliver about \_\_\_\_\_.
  - 4 gpm
  - 11 gpm
  - 16 gpm
  - 20 gpm
  - none on chart



# Water Wells Fundamentals Part 2- Bold Copy

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**Quiz 7** – Chapter 7 – Interpolation / Pipe sizing  
 Use the PE Pipe Head Losses Table in this work sheet.

PE Pipe Head Losses (ft H <sub>2</sub> O/100 ft pipe)												
Volume Flow		Nominal Pipe Diameter (inches)										
Gallons Per Minute)	Gallons Per Hour	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	6
		Nominal Inside Diameter (inches)										
		0.493	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026	6.065
1	60	3.3	1.1	0.3								
2	120	11.8	3.8	1.0	0.3	0.1						
4	240	42.5	13.7	3.5	1.1	0.3	0.1					
5	300	64.2	20.7	5.3	1.6	0.4	0.2					
6	360		29.0	7.4	2.3	0.6	0.3					
8	480		49.5	12.6	3.9	1.0	0.5	0.1				
10	600		74.7	19.0	5.9	1.6	0.7	0.2	0.1			
20	1200			68.6	21.2	5.6	2.6	0.8	0.3	0.1		
30	1800					11.8	5.6	1.7	0.7	0.2		
40	2400					20.1	9.5	2.8	1.2	0.4	0.1	
50	3000						14.4	4.3	1.8	0.6	0.2	
60	3600						20.1	6.0	2.5	0.9	0.2	
70	4200							7.9	3.3	1.2	0.3	
80	4800							10.2	4.3	1.5	0.4	
90	5400							12.6	5.3	1.9	0.5	
100	6000								6.5	2.3	0.6	0.1
125	7500								9.8	3.4	0.9	0.1
150	9000									4.8	1.3	0.2

1. 25 gpm for 1-1/4 inch dia. PE pipe:
  - 5.7
  - 6.2
  - 8.7
  - 9.1
  - 10.5
  
2. 55 gpm for 2-1/2 inch dia. PE pipe:
  - 2.15
  - 6.2
  - 8.2
  - 9.1
  - 10.5
  
3. 15 gpm for 3/4 inch dia. PE pipe:
  - 21.2
  - 28.9
  - 43.8
  - 51.9
  - 67.1

# Water Wells Fundamentals Part 2- Bold Copy

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## Quiz 8 – Chapter 8

- A two wire 115 VOLT system has \_\_\_\_\_.
  - only a black wire and a red wire
  - only a black wire and a white wire
  - only a black wire, a white wire, and a green wire
  - none of the answers provided
- A black and red wire used for power indicates a \_\_\_\_\_ system.
  - 12 volt
  - 115 volt
  - 230 volt
  - 460 volt
  - none of the answers provided
- What can happen if a pump motor seized?
  - The pump could overheat.
  - The pump motor could melt the protective insulation on the motor windings, short out and destroy the motor.
  - The pump motor would run at high speed.
  - None of the answers provided.

- A(n) \_\_\_\_\_ is a float switch to turn off the pump when the storage tank is full.
  - open on level rise
  - a close on level rise
  - both of the answers provided
  - neither of the answers provided
- Float switches can be added one after the other to serve as a safety control.
  - True
  - False
- A pressure switch is rated at 30/50 psi, means \_\_\_\_\_.
  - when pressure is 30 psi or less, the pump is activated
  - when the pressure is 50 (or above) psi, the pump is turned off
  - when the pressure is 40 psi the pump may or may not be activated
  - all of the answers provided
  - none of the answers provided
- A 115 volt pump uses \_\_\_\_\_ set(s) of contacts, while a 230 volt pump uses \_\_\_\_\_ set(s) of contacts.
  - 1 – 2
  - 2 – 1
  - 1 – 1
  - 2 – 2
  - 2 – 3

## Jet Pump Motor Data and Electrical Components

### A.O. SMITH MOTOR DATA

GP Number	Where Used	A.O. Smith	HP	Volts	Phase	Service Factor	Max. Load Amps	Watt
J04853	J05, HB705	C48J2DB11C3HF	1/2	115/230	1	1.6	10.8/5.4	880
J05853	JL07N, HSJ07, XSH07, HB	C48K2DB11A4HH	3/4	115/230	1	1.5	14.8/7.4	1280
J06853	JL10N, HSJ10, SJ10, XSH10, HB	C48L2DB11A4HH	1	115/230	1	1.4	16.2/8.1	1440
J07858	HSJ15, SJ15, HB, XSH15	C48M2DB11A1HH	1 1/2	115/230	1	1.3	20.0/10.0	1866
J08854	HSJ20, HSC20, XSH20	K48N2DB11A2HH	2	115/230	1	1.2	22.6/11.3	2100
J09853	XSH30, GT30	C56P2U11A3HH	3	230	1	1.15	17.2	3280
J04853L	JS/SJ, GR	C48A93A06	1/2	115/230	1	1.6	10.8/5.4	968

- An A.O. Smith 3 Hp. / 230 volts/ 1 phase motor requires a \_\_\_\_\_ amp circuit breaker.
  - 10
  - 15
  - 20
  - 25
  - 30
- An A.O. Smith 1-1/2 Hp. motor / 230 volts 1 phase requires a \_\_\_\_\_ amp circuit breaker.
  - 10
  - 15
  - 20
  - 25
  - 30
- On electrical diagrams for 115 volt circuits, L1 is a black wire and L2 is a white wire that can be labeled \_\_\_\_\_.
  - N
  - Neutral
  - Both of the answers provided
  - Neither of the answers provided

- To lower the cut ON & OFF pressures on a pressure control, turn the No. \_\_\_\_\_ nut \_\_\_\_\_.
  - #1 – CW
  - #1 – CCW
  - #2 – CW
  - #2 – CCW
- To lower the cut OFF pressures on a pressure control, turn the No. \_\_\_\_\_ nut \_\_\_\_\_.
  - #1 – CW
  - #1 – CCW
  - #2 – CW
  - #2 – CCW
- The maximum Hp. that a pressure switch can directly control is \_\_\_\_\_.
  - 1.5 Hp. @ 115v
  - 1.5 Hp. @ 230v
  - 2.0 Hp. @ 115v
  - 5.0 Hp. @ 230vz

# Water Wells Fundamentals Part 2- Bold Copy

RV 2.16.24

## Quiz 9 – Chapter 8

1. When the coil is de-energized, the contacts on a contactor are \_\_\_\_\_.
  - open
  - closed welded shut
  - intermittent
  - none of the answers provided
2. The motor rotor turns the pumping mechanism.
  - True
  - False
3. The motor stator consists of \_\_\_\_\_.
  - copper coils
  - aluminum bars
  - steel plates
  - iron plates
  - none of the answers provided
4. A single-phase motor has \_\_\_\_\_ sets of coils.
  - 1
  - 2
  - 3
  - 4
  - 5
5. The S terminal on motor windings indicates the \_\_\_\_\_ coil.
  - start
  - stationary
  - safety
  - sliding
  - steady
6. A start capacitor \_\_\_\_\_ the starting torque of the motor.
  - neutralizes
  - cancels out
  - decreases
  - gives an extra boost to help
  - none of the answers provided
7. A run capacitor \_\_\_\_\_ overall efficiency of the motor.
  - neutralizes
  - cancels out
  - decreases
  - increases
  - none of the answers provided
8. A PSC motor uses \_\_\_\_\_ to dis-engage the start windings.
  - centrifugal switch
  - potential relay
  - current relay
  - no relays since S winding are left in the circuit
9. A submersible pump would use \_\_\_\_\_ wires from the control box to the pump motor.(Do not count the ground wire)
  - 2
  - 3
  - 4
  - 5
10. To change direction of rotation of a 3 phase motor, simply switch \_\_\_\_\_ of the power wires.
  - 1
  - 2
  - 3
  - 4
  - 5
11. The \_\_\_\_\_ discharge pressure on a 3 phase pump indicates the correct pump rotation.
  - highest
  - lowest
  - average
  - zero
  - none of the answers provided
12. A mag-starter will prevent single phasing on a 3 phase motor.
  - True
  - False
13. Surge protectors have \_\_\_\_\_ which passes the surge to ground.
  - MOV
  - ABC
  - 123
  - XYZ
  - none of the answers provided
14. A Pump Saver protects a pump motor from \_\_\_\_\_.
  - drywell
  - dead-head
  - jammed impeller
  - overvoltage
  - all of the answers provided