TPG4145 IN-CLASS QUIZ #2 **Name:** _____

TPG 4145 Quiz 2 (held Nov. 21, 2013)

M=5: solve for <u>all</u> values in blue empty boxes.

	Test Reservoir Rate Constant (Darcy)	CR	20	scf/D/psia^2
	Test Tubing Rate Constant	CT	25000	scf/D/psia
	Initial Gas In Place	G	1.00E+12	scf
	Permeability	k	20	md
	Net Thickness	h	164	ft
	Skin	s	8.7	(slightly changed from class value)
	Reservoir Temperature	TR	150	oF
	Initial Reservoir Pressure	pRi	2000	psia
	Irreducible (connate) water saturation	Swi	0.2	fraction
	Aquifer volume ratio	M	5	-
	Water compressibility	cw	3.50E-06	1/psi
	Formation rock (pore) compressibility	cf	7.00E-06	1/psi
	Gas specific gravity	γg	0.70	air=1
	Low-pressure gas viscosity	ug	0.0143	cp
	Low-pressure Z-factor	Zg	1	
	Test tubing inner diameter	dT	3.5	in
	True vertical depth top reservoir	TVD	5000	ft
	Static gas column average temperature	Tavg	130	oF
	Static gas column average Z-factor	Zgavg	0.94	-
	Minimum flowing tubing pressure	ptmin	500	psia
	%IGIP sold per year	Δ(Gp/G)	0.055	fraction
	Plateau period	tplateau	10	years
	Drainage area radius ratio term	ln(re/rw)-0.75	8	
1	Daily Field Rate	qgF		scf/D
2	Static gas column constant	S		-
	Static gas column constant	exp(S)		convert bottomhole p^2 to surface p^2
	Static gas column constant	exp(S/2)		convert bottomhole p to surface p
3	CR from equation = 1/Awh (Eq. 19)	CR		Mscf/D/psia^2
	(in terms of pc and pw)			scf/D/psia^2

Assume Material Balance ignoring Zg (set Zg=1 at all pressures),
but including "ce" term; solve as quadratic equation for pR.

4	Effective cumulative compressibility	ce		1/psi
5	Average reservoir pressure at end plateau	pR		psia
6		pc		psia
	Unmodified (Test) Well			
7	Well qg with ptmin at end plateau	qg		scf/D
8	Number of wells required at end plateau	Nw		
9	Modify dT=6 inches (inner diameter)	CT		scf/D/psia
10	Well qg with ptmin at end plateau	qg		scf/D
11	Number of wells required at end plateau	Nw		
12	Modify s=-4	CR		scf/D/psia^2
13	Well qg with ptmin at end plateau	qg		scf/D
14	Number of wells required at end plateau	Nw		
15	Modify s=-4	CR		scf/D/psia^2
16	Modify dT=6 inches (inner diameter)	CT		scf/D/psia
17	Well qg with ptmin at end plateau	qg		scf/D
18	Number of wells required at end plateau	Nw		
19	% (pc-pt) in <u>reservoir</u> at end plateau	(pc-pw)/(pc-pt)		%
20	% (pc-pt) in <u>tubing</u> at end plateau	(pw-pt)/(pc-pt)		%

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Below you find a solved solution to the Quiz for M=10. You may find it useful in helping you solve for M=5.

	Test Reservoir Rate Constant (Darcy)	CR	20	scf/D/psia^2
	Test Tubing Rate Constant	CT	25000	scf/D/psia
	Initial Gas In Place	G	1.00E+12	scf
	Permeability	k	20	md
	Net Thickness	h	164	ft
	Skin	s	8.7	(slightly changed from class value)
	Reservoir Temperature	TR	150	oF
	Initial Reservoir Pressure	pRi	2000	psia
	Irreducible (connate) water saturation	Swi	0.2	fraction
	Aquifer volume ratio	M	10	-
	Water compressibility	cw	3.50E-06	1/psi
	Formation rock (pore) compressibility	cf	7.00E-06	1/psi
	Gas specific gravity	γg	0.70	air=1
	Low-pressure gas viscosity	ug	0.0143	cp
	Low-pressure Z-factor	Zg	1	
	Test tubing inner diameter	dT	3.5	in
	True vertical depth top reservoir	TVD	5000	ft
	Static gas column average temperature	Tavg	130	oF
	Static gas column average Z-factor	Zgavg	0.94	-
	Minimum flowing tubing pressure	ptmin	500	psia
	%IGIP sold per year	Δ(Gp/G)	0.055	fraction
	Plateau period	tplateau	10	years
	Drainage area radius ratio term	ln(re/rw)-0.75	8	
1	Daily Field Rate	qgF	1.51E+08	scf/D
2	Static gas column constant	S	0.237	-
	Static gas column constant	exp(S)	1.267	convert bottomhole p^2 to surface p^2
	Static gas column constant	exp(S/2)	1.126	convert bottomhole p to surface p
3	CR from equation = 1/Awh (Eq. 19)	CR	0.0200	Mscf/D/psia^2
	(in terms of pc and pw)		20.0	scf/D/psia^2
	Assume Material Balance ignoring Zg (set Zg=1 at all pressures), but including "ce" term; solve as quadratic equation for pR.			
4	Effective cumulative compressibility	ce	1.41E-04	1/psi
5	Average reservoir pressure at end plateau	pR	1041	psia
6		pc	925	psia
	Unmodified (Test) Well			
7	Well qg with ptmin at end plateau	qg	9.32E+06	scf/D
8	Number of wells required at end plateau	Nw	17	
9	Modify dT=6 inches (inner diameter)	CT	101521	scf/D/psia
10	Well qg with ptmin at end plateau	qg	1.18E+07	scf/D
11	Number of wells required at end plateau	Nw	13	
12	Modify s=-4	CR	83.6	scf/D/psia^2
13	Well qg with ptmin at end plateau	qg	1.61E+07	scf/D
14	Number of wells required at end plateau	Nw	10	
15	Modify s=-4	CR	83.6	scf/D/psia^2
16	Modify dT=6 inches (inner diameter)	CT	101521	scf/D/psia
17	Well qg with ptmin at end plateau	qg	3.85E+07	scf/D
18	Number of wells required at end plateau	Nw	4	
19	% (pc-pt) in reservoir at end plateau	(pc-pw)/(pc-pt)	70	%
20	% (pc-pt) in tubing at end plateau	(pw-pt)/(pc-pt)	30	%