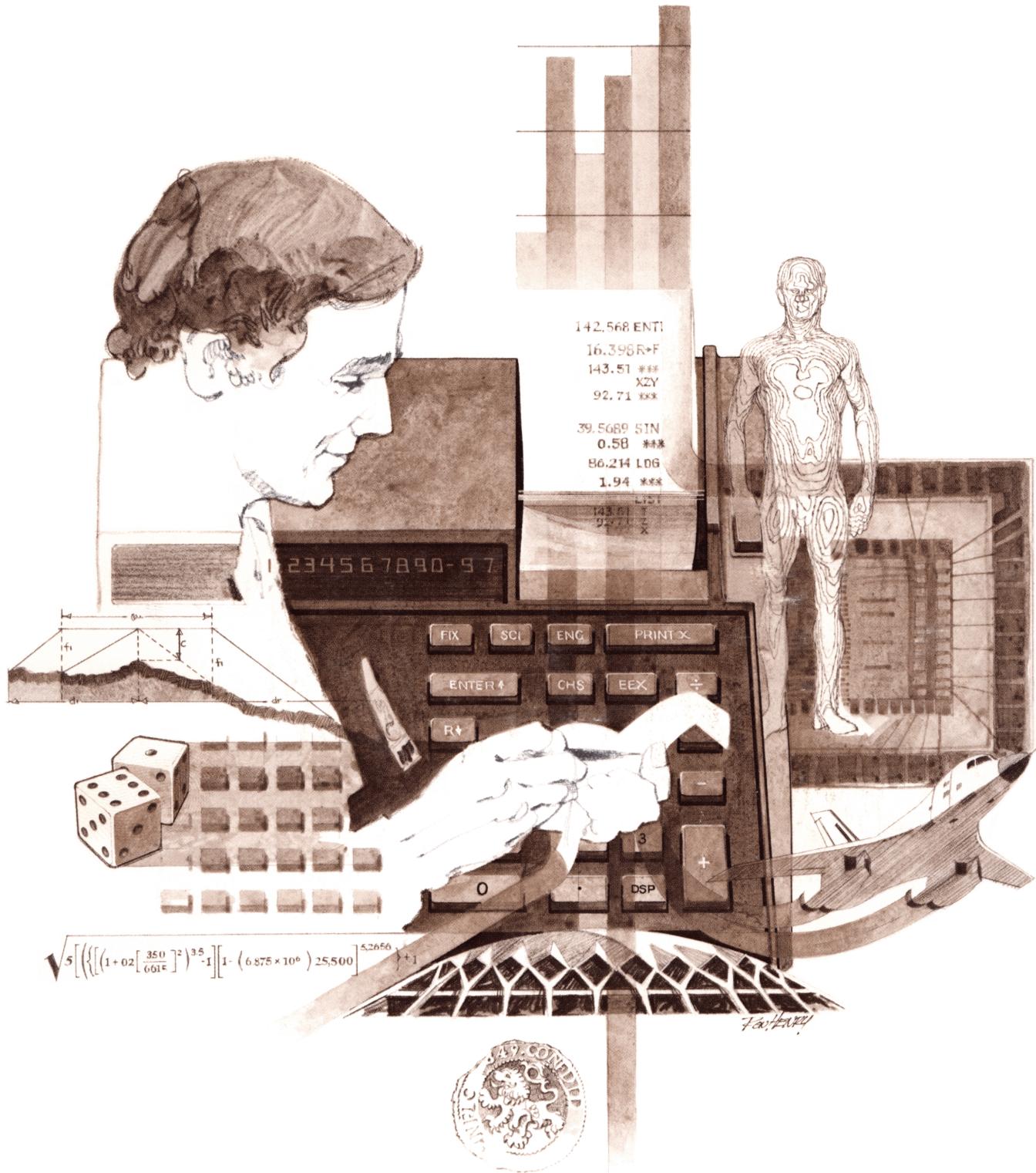


HEWLETT-PACKARD

HP-67/HP-97

Users' Library Solutions Anesthesia



INTRODUCTION

In an effort to provide continued value to its customers, Hewlett-Packard is introducing a unique service for the HP fully programmable calculator user. This service is designed to save you time and programming effort. As users are aware, Programmable Calculators are capable of delivering tremendous problem solving potential in terms of power and flexibility, but the real genie in the bottle is program solutions. HP's introduction of the first handheld programmable calculator in 1974 immediately led to a request for program **solutions** — hence the beginning of the HP-65 Users' Library. In order to save HP calculator customers time, users wrote their own programs and sent them to the Library for the benefit of other program users. In a short period of time over 5,000 programs were accepted and made available. This overwhelming response indicated the value of the program library and a Users' Library was then established for the HP-67/97 users.

To extend the value of the Users' Library, Hewlett-Packard is introducing a unique service—a service designed to save you time and money. The Users' Library has collected the best programs in the most popular categories from the HP-67/97 and HP-65 Libraries. These programs have been packaged into a series of low-cost books, resulting in substantial savings for our valued HP-67/97 users.

We feel this new software service will extend the capabilities of our programmable calculators and provide a great benefit to our HP-67/97 users.

A WORD ABOUT PROGRAM USAGE

Each program contained herein is reproduced on the standard forms used by the Users' Library. Magnetic cards are not included. The Program Description I page gives a basic description of the program. The Program Description II page provides a sample problem and the keystrokes used to solve it. The User Instructions page contains a description of the keystrokes used to solve problems in general and the options which are available to the user. The Program Listing I and Program Listing II pages list the program steps necessary to operate the calculator. The comments, listed next to the steps, describe the reason for a step or group of steps. Other pertinent information about data register contents, uses of labels and flags and the initial calculator status mode is also found on these pages. Following the directions in your HP-67 or HP-97 **Owners' Handbook and Programming Guide**, "Loading a Program" (page 134, HP-67; page 119, HP-97), key in the program from the Program Listing I and Program Listing II pages. A number at the top of the Program Listing indicates on which calculator the program was written (HP-67 or HP-97). If the calculator indicated differs from the calculator you will be using, consult Appendix E of your **Owner's Handbook** for the corresponding keycodes and keystrokes converting HP-67 to HP-97 keycodes and vice versa. No program conversion is necessary. The HP-67 and HP-97 are totally compatible, but some differences do occur in the keycodes used to represent some of the functions.

A program loaded into the HP-67 or HP-97 is not permanent—once the calculator is turned off, the program will not be retained. You can, however, permanently save any program by recording it on a blank magnetic card, several of which were provided in the Standard Pac that was shipped with your calculator. Consult your **Owner's Handbook** for full instructions. A few points to remember:

The Set Status section indicates the status of flags, angular mode, and display setting. After keying in your program, review the status section and set the conditions as indicated before using or permanently recording the program.

REMEMBER! To save the program permanently, **clip** the corners of the magnetic card once you have recorded the program. This simple step will protect the magnetic card and keep the program from being inadvertently erased.

As a part of HP's continuing effort to provide value to our customers, we hope you will enjoy our newest concept.

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Body surface area, estimated blood volume, acceptable blood loss, normal and surgical fluid requirements and deficits and other parameters may be calculated with this program.	
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Calculates initial tidal volume for a ventilator patient, using the Radford nomogram with corrections for patient's temperature, altitude, activity level, presence of tracheostomy and metabolic acidosis in anesthesia. Deadspace required to normalize PCO ₂ for a patient with respiratory alkalosis is estimated.	
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Program Description I

Program Title Anesthesiology Parameters

Contributor's Name Charles W. DOLLINGER

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City Bremerton

State Wash

Zip Code 98310

Program Description, Equations, Variables

Height, weight and age can be input in English or metric terms. Program computes and stores estimated blood volume for weight and age groups (below or above 10 years old).

Given the number of drops per ml. of intravenous delivery system, one routine gives the sodium nitroprusside dose in mcg/min as well as recommended solution strength in percent and administration rate in drops/min.

Given the surgery starting time (hours and minutes since last intake, usually midnight) program calculates body surface area and normal fluid requirement ($1500 \text{ ml/m}^2/24\text{ h}$) and deficit, then the surgical requirement ($2500 \text{ ml/m}^2/24\text{ h}$) and will give surgical requirement and total deficit.

Given systolic and diastolic blood pressures, calculates mean arterial pressure. If a laboratory-determined blood volumes is available, it should be used in preference to figure calculated and stored in E. Enter Hct and BV in LBL d.

For repeat cases, or if no laboratory value available, enter Hct. and use LBL d.

When finding delivered concentration first time, use of routine LBL e will store vaporpressure for agent in use. Repeat performances require only diluent and kettle flows to LBL E, unless agent or temperature changes.

Operating Limits and Warnings

Use 24-hour clock. If a patient has been NPO since 0400 instead of 0000, and surgery begins at 0800, use "4.0" to enter routine B.

If prevalent barometric pressure other than 760, alter program prior to use.

Clinical: Acceptable loss assumes and depends on full hydration. Combining hydration

figures (LBLS) and ABL (ABLd): when amount equal to ABL is shed, HCT will be 30%.

Serum protein measured periodically - deficit replaced with albumin. Packed RBC's for Hct < 30%.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

Sketch(es)

Sample Problem(s)

- ① Patient is 68.5" tall, 175#, age 41 enter data
- ② Surgery begins at 9:15. Patient NPO since midnight. What is starting deficit + requirements? What is the status at 10:25? Pt has received 1100 ml intravenously, how is his hydration?
- ③ Patients hematocrit is 45%. What is acceptable loss? During procedure, hematocrit is found to be 25%. Hydration is good. How many ml. of packed RBC to transfuse? (negative sign indicates difference between acceptable loss and RBC's to infuse)
- ④ At this temperature, the vapor pressure of Wonderthane is 170. Diluent 2500 ml, kettle flow 120. What is delivered concentration? flow technique: Fd is 2000 ml, kettle flow 80:
- ⑤ Intravenous sets administer 12 drops/min. How is sodium nitroprusside to be given?

Solution(s)

① 68.5 ↑ 175# ↑ 41 [f] [a]	→ 5556 (est. B.V.)	③ 45 [d] → 1852 ml. ABG
② 9:15 [B]	→ 1.94 BSA m ²	25 [d] → -278 ml RBC
	→ 121 ml EFR normally	④ 2500 ↑ 120 ↑ 170 [fe] → 1.4 %
	→ -1122 Starting deficit ml.	2000 ↑ 80 [E] → 1.2 %
10:25 [R/s]	→ 202 Surgical EFR	⑤ 12 [f] [b] → 19.2 µg/min
	→ "238" Surgical deficit	→ 0.0100 % sol
	→ -1358 Total deficit	→ 23 drops/min
1100 [+]	→ -258 Remaining deficit	

Reference(s) Mazze, Richard I: Intraoperative fluid therapy - ASA Refresher Course - 1976

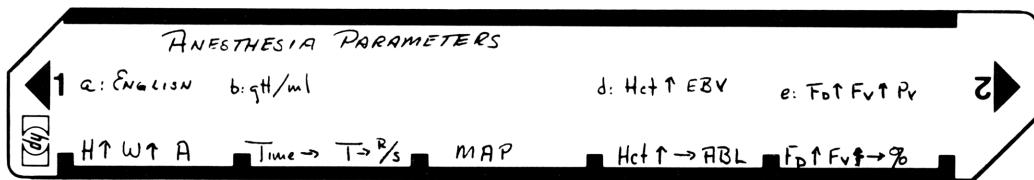
Lawson, N.W. et. al: Fl dosage nomogram for sodium-nitroprusside-induced hypotension under anesthesia. Anes. Analg 55: 574-579, 1976

Bennett, Edward J: Fluid replacement in infants and children - ASA Refresher Course 1976

Furnau, Eric J: Acceptable blood loss computation - personal communication.

User Instructions

3



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1.	Load program side 1 and side 2.			
2.	Enter patient data Height in inches or cm Weight in pounds or kg Age : if above entered in English units (inch/pound) if above entered in Metric units (cm/kg)	H W A A	ENTER ↑ ENTER ↑ f a F	
3.	To find body surface area and fluid factors: Input start of surgery or time NPO	H.M	B	BSA (m^2) NORMAL EFR (ml) STARTING DEFICIT SURGICAL EFR "Surgeon Deficit" TOTAL DEFICIT
	FOR PRESENT STATUS, INPUT Present time Fluid administered may be added to last figure for balance figure (positive value, overload; negative, deficit)	H.M	R/S	
4.	For sodium nitroprusside administration, input number of drops/ml of I.V. administration set (recompute with different set type if drops too high or too low.)	gtt/ml.	f b	Admin: $\mu g/min$ % solution Admin: gtt/min
5.	For mean arterial pressure Input systolic INPUT diastolic	Sys. Dias	ENTER ↑ C	M.A.P. mmHg
6.	For acceptable blood loss, input hematocrit if EBV determined, input for new case, or if EBV not known, input hem	Hct EBV Hct	ENTER ↑ f d D	ABL (ml) OR - RBC (ml)
7.	For delivered concentration, Input diluent flow Input kettle flow Input vapor press for new case, same agent, same temp: Input diluent flow Input kettle flow	F _D (ml) F _V (ml) P _V (mmHg) F _D (ml) F _V (ml)	ENTER ↑ ENTER ↑ f e ENTER ↑ E	% conc. % conc.

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLa	21 16 11		057	2	02	
002	STOC	35 13		058	X≤Y?	16-35	Compare dose with
003	R↓	-31		059	GT01	22 01	constants to determine proper con-
004	2	02		060	CLX	-51	centration
005	.	-62		061	2	02	
006	2	02		062	5	05	
007	0	00		063	X≤Y?	16-35	
008	5	05		064	GT02	22 02	
009	÷	-24		065	EEX	-23	
010	STOB	35 12		066	5	05	
011	R↓	-31		067	÷	-24	
012	2	02		068	*LBL0	21 00	
013	.	-62		069	DSP5	-63 05	
014	5	05		070	PRTX	-14	Display concentra-
015	4	04		071	DSP0	-63 00	tion in percent.
016	X	-35		072	CLX	-51	
017	GT03	22 03		073	LSTX	16-63	
018	*LBLA	21 11		074	÷	-24	Determine proper
019	STOC	35 13		075	X	-35	administration rate
020	R↓	-31		076	PRTX	-14	
021	STOB	35 12		077	SPC	16-11	
022	R↓	-31		078	RTN	24	
023	*LBL3	21 03		079	*LBL1	21 01	
024	STOA	35 11		080	1/X	52	
025	RCLC	36 13		081	GT00	22 00	
026	1	01		082	*LBL2	21 02	
027	0	00		083	2	02	
028	X≤Y?	16-35		084	X	-35	
029	FRC	16 44		085	EEX	-23	
030	7	07		086	3	03	
031	0	00		087	÷	-24	
032	+	-55		088	GT00	22 00	
033	RCLB	36 12		089	RTN	24	
034	X	-35		090	*LBLB	21 12	
035	STOE	35 15		091	HMS↑	16 36	
036	RTN	24		092	ST00	35 00	
037	*LBLb	21 16 12		093	RCLB	36 12	Compute body surface
038	RCLC	36 13		094	.	-62	area.
039	RCLB	36 12		095	4	04	
040	÷	-24		096	2	02	
041	2	02		097	5	05	
042	.	-62		098	Y*	31	
043	6	06		099	RCLA	36 11	
044	3	03		100	.	-62	
045	CHS	-22		101	7	07	
046	X	-35		102	2	02	
047	e ^x	33		103	5	05	
048	7	07		104	Y*	31	
049	4	04		105	.	-62	
050	8	08		106	0	00	
051	.	-62		107	0	00	
052	7	07		108	7	07	
053	X	-35		109	1	01	
054	PRTX	-14		110	8	06	
055	RND	16 24		111	4	04	
056	EEX	-23		112	X	-35	

REGISTERS

0 Start time/dec	1 Vapor pressure	2	3	4	5	6	7	8	9
S0 hrs.	S1	S2	S3	S4	S5	S6	S7	S8	S9
A Height (cm)	B Weight (bg)	C Age (yr)	D BSA (M ²)		E EBV (ml)	I Used			

97 Program Listing II

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	X	-35		169	-	-45	Does pt. have less
114	DSP2	-63 02		170	X<0?	16-45	than HCT 30% - jump
115	PRTX	-14		171	GT04	22 04	
116	DSP0	-63 00		172	RCLI	36 46	Divide acceptable
117	STOD	35 14		173	÷	-24	red cell loss by HCT
118	1	01	Normal EFR is	174	PRTX	-14	to find ABL
119	5	05	1500ml/m ² /24h	175	RTN	24	
120	0	00		176	*LBL4	21 04	Adjust figure for
121	0	00		177	EEX	-23	ml. red blood cell
122	X	-35		178	2	02	deficit
123	2	02		179	÷	-24	
124	4	04		180	PRTX	-14	
125	÷	-24		181	RTN	24	
126	PRTX	-14		182	*LBL4	21 16 15	Store vapor pressure
127	RCL0	36 00		183	STO1	35 01	
128	X	-35		184	R↓	-31	
129	CHS	-22		185	*LBL4	21 15	Calculate delivered
130	PRTX	-14		186	RCL1	36 01	concentration
131	RCLD	36 14		187	X	-35	
132	2	02	Surgical EFR is	188	X*Y	-41	
133	5	05	2500ml/m ² /24h	189	7	07	
134	0	00		190	6	06	
135	0	00		191	0	00	
136	X	-35		192	RCL1	36 01	
137	2	02		193	-	-45	
138	4	04		194	X	-35	
139	÷	-24		195	÷	-24	
140	PRTX	-14		196	EEX	-23	
141	SPC	16-11		197	2	02	
142	R/S	51		198	X	-35	
143	HMS+	16 36	Find duration of	199	DSP1	-63 01	
144	RCL0	36 00	surgery to present	200	PRTX	-14	
145	-	-45	time	201	DSP0	-63 00	
146	X	-35		202	SPC	16-11	
147	PSE	16 51	Show deficit gener-	203	RTN	24	
148	-	-45	ated since start of				
149	RTN	24	surgery				
150	*LBL4	21 13	Display total defi-				
151	STOI	35 46	cit				
152	-	-45					
153	3	03	Mean arterial				
154	÷	-24	pressure:	210			
155	RCLI	36 46	<u>Sys-Dias</u>				
156	+	-55	+Dias				
157	RTN	24					
158	*LBL4	21 16 14					
159	STOE	35 15	Store est. blood				
160	R↓	-31	vol. from labora-				
161	*LBL4	21 14	tory determination				
162	STOI	35 46					
163	RCL4	36 15	Find est. red cell				
164	X	-35	mass	220			
165	3	03					
166	0	00					
167	RCL4	36 15	Subtract est. red				
168	X	-35	cell mass @ HCT 30%				

LABELS

LABELS					FLAGS	SET STATUS		
A	B	C	D	E	0	FLAGS	TRIG	DISP
store data	BSA	EFR	M.A.P.	A.B.L.	0	ON OFF	DEG	FIX
a convert &	bSod	cnitro	dABL	e% conc.	1	0 <input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
store data	procs		Lab.	EBV	2	1 <input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Subr. conc	Comparison	Comparison	Compute EBV	Pv supplied	3	2 <input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	(b)	6	7	Compute RBC	4	3 <input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
			8		9			
					3			

Program Description I

Program Title ANESTHESIA PARAMETERS II

Contributor's Name CHARLES W. BOLLINGER

Address 644 LONGSHAW DRIVE

City BREMERTON

State WASH

Zip Code 98310

Program Description, Equations, Variables

THE ANTOINE EQUATION IS: $\log_{10} P = A + \frac{-B}{T+C}$ WHERE A, B, AND C ARE CONSTANTS FOR EACH AGENT. CONSTANTS THAT ARE AVAILABLE FOR VARIOUS AGENTS HAVE BEEN INCORPORATED. AS THE USER FINDS MORE FROM MANUFACTURER OR LITERATURE, HE CAN ADD THEM TO THE DATA BANKS AS FOLLOWS:

CONSTANT A: PLACE IN REGISTER S_x OF THE PAIR TO BE USED FOR THAT AGENT (SUCH AS R_9, S_9)

CONSTANT B: MULTIPLY BY 100, TAKE INTEGER, AND STORE IN R_x

CONSTANT C: DIVIDE BY 1000, TAKE FRACTION AND ADD TO R_x

EXAMPLE: CONSTANTS FOR ETHER ARE: A=6.78574, B=994.195, C=220.0 - SEE HOW THIS RULE WAS FOLLOWED TO INSERT VALUES IN S_9 AND R_9 , RESPECTIVELY.

DELIVERED CONCENTRATION AND TABLE ARE BASED ON OUTPUT CONCENTRATION AND TOTAL FLOW, AND ARE HIGHLY ACCURATE. IT IS ACKNOWLEDGED THAT DELIVERY VIA A CIRCLE OR OTHER SUCH SYSTEM WILL ALTER CONCENTRATION. VALUES ARE FOR NON-REBREATHTING SYSTEM.

IT SOMETIMES SURPRISES THE STUDENT TO DISCOVER THAT THE OUTPUT OF A VAPORIZER CAN BE MORE THAN TWICE INPUT, AS WITH ETHER. ROUTINE D GIVES BASIC DATA.

Operating Limits and Warnings

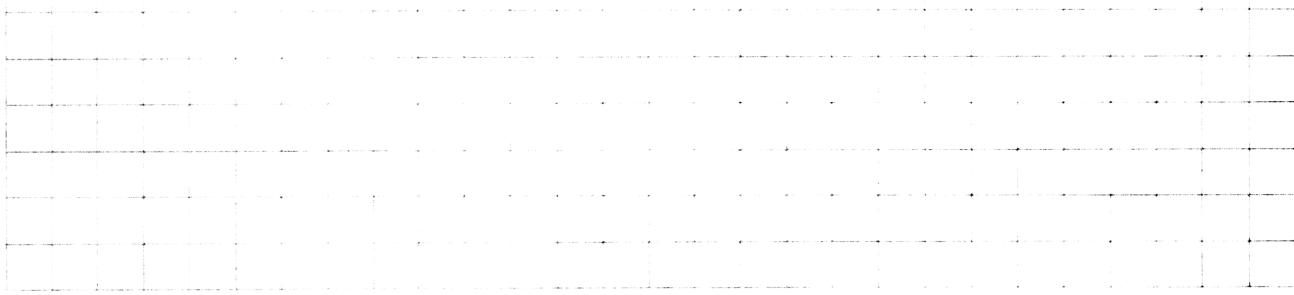
- ① BAROMETRIC PRESSURE USED IS 260. USE OTHER VALUES AS NECESSARY FOR AREAS OF DIFFERENT PREVAILING P_b . FOR LABORATORY ACCURACY, ROUTINE LBL1 MAY BE USED TO STORE AND CONVERT P_b USING THE J-REGISTER AFTER P_v HAS BEEN COMPUTED
- ② WHEN A TABLE OF VAPOR PRESSURES HAS BEEN GENERATED, THE TEMPERATURE VALUE IN E-REGISTER WILL HAVE BEEN INCREMENTED AND NEW OR PREVIOUS VALUE MUST BE ENTERED FOR NEW CASE

This program has been verified only with respect to the numerical example given in Program Description II. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

Sketch(es)



Sample Problem(s)

- ① THE TEMPERATURE OF THE O.R. IS 68.5°F. WHAT IS Pv OF HALOTHANE?
- ② STARTING WITH 18°C, INCREMENTS OF 0.5°C, WHAT ARE Pv's OF CHLOROFORM?
- ③ OR TEMP IS 21°C. HALOTHANE IS BEING GIVEN IN A KETTLE WITH A FLOW OF 85 ml. DIULVENT FLOW IS 2.5 L. WHAT IS DELIVERED CONCENTRATION OF HALOTHANE?
KETTLE FLOW IS REDUCED TO 25 ml - WHAT IS NEW CONCENTRATION?
- ④ MAKE A TABLE FOR METHOXYFLURANE STARTING WITH KETTLE FLOW OF 20 ml AND INCREASING IN 20 ml INCREMENTS. DIULVENT FLOW IS 2000, TEMP 20°
- ⑤ IF FLOW INTO KETTLE IS 150 ml, WHAT IS QUANTITY AND CONCENTRATION OF SATURATED VAPOR? (STILL METHOXYFLURANE)

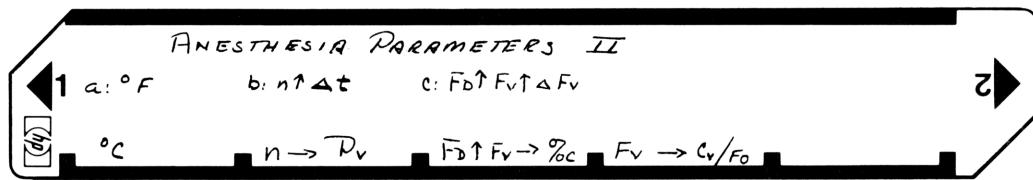
Solution(s)

	③ 21[A] → 21 °C	→ 20
① 68.5 [f][a] → °C	4[B] → 21	→ 0.03
4[B] → 20.3 °C	→ 253.2	→ 40
→ 245.6 Pv	2500[↑] 85[c] → 1.6 %	→ 0.06
② 18[A] → 18 °C	2500[↑] 25[c] → 0.49 %	⑤ 150[D] → 2.99 %
2[↑] 0.5[f][b] → 18 °C	④ 20[A] → 20	→ 154.62 ml
→ 145.9 Pv	5[B] → 20	
→ 18.5 °C	→ 22.72	
→ 149.1 Pv	2000[r] 20[i] 20[s] → 2000	
etc		

Reference(s)

- de Jong, Rudolph H: VAPOR PRESSURE TABLES. ANESTHESIOLOGY 34: 569-70, 1971
 Nahrwold, M.L. et.al: ESTIMATION OF AN EQUATION RELATING SATURATED VAPOR PRESSURE TO TEMPERATURE. ANESTHESIOLOGY 39: 444-446, 1973

User Instructions



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	LOAD PROGRAM SIDE 1 AND SIDE 2			
2	LOAD DATA SIDE 1 AND SIDE 2			
3	INPUT VAPORIZER TEMPERATURE IN CELSIUS IN FAHRENHEIT	$T (^{\circ}\text{C})$ $T (^{\circ}\text{F})$	A f a	$T (^{\circ}\text{C})$
4.	INPUT SELECTION NUMBER: 1. ETHER 2. CHLOROFORM 3. TRICLORETHYLENE 4. HALOTHANE 5. METHOXYFLURANE	6. ISOFLURANE n	B	$T (^{\circ}\text{C})$ P_v
5	FOR VAPOR PRESSURE TABLE: INPUT SELECTION NUMBER INPUT INCREMENTS OF TEMPERATURE	n $\Delta t (^{\circ}\text{C})$	ENTER ↑ f b	$(T (^{\circ}\text{C}))$ P_v
6	FOR DELIVERED CONCENTRATION INPUT DILUENT FLOW INPUT FLOW THROUGH VAPORIZER	$F_d (\text{ml})$ $F_v (\text{ml})$	ENTER ↑ C	% conc
7.	FOR DELIVERED CONCENTRATION TABLE: INPUT DILUENT FLOW INPUT FLOW THROUGH VAPORIZER INPUT INCREMENTS OF FLOW THROUGH VAPORIZER $\Delta F_v (\text{ml})$	$F_d (\text{ml})$ $F_v (\text{ml})$ $\Delta F_v (\text{ml})$	ENTER ↑ f c	F_d (F_v) $\%_{\text{conc}}$
8	FOR CONCENTRATION OF SATURATED VAPOR AND OUTPUT OF VAPORIZER, INPUT FLOW THROUGH VAPORIZERS	F_v	D	$\%_{\text{Cv}}$ F_o

LABELS					FLAGS		SET STATUS		
A	B	C	D	E	0	FLAGS	TRIG	DISP	
STORE $^{\circ}\text{C}$	VAPOR PRESSURE	% DELIV. CONC.	$C_v + F_o$		0	ON OFF	DEG	FIX	
a CONVERT $^{\circ}\text{F}$ to $^{\circ}\text{C} \cdot \text{store}$	b Pv TABLE	c " TABLE	d	e	1	1 <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>	
0 REPEAT Pv	1 REPEAT CONC	2	3	4	2	2 <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>	
5	6	7	8	9	3	3 <input type="checkbox"/>	n <input type="checkbox"/>		

97 Program Listing I

9

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 16 11		057	STOB	35 12	
002	3	03		058	R↓	-31	
003	2	02		059	STOA	35 11	
004	-	-45		060	X+Y	-41	
005	5	05		061	STOC	35 13	
006	x	-35		062	PRTX	-14	
007	9	09		063	X+Y	-41	PRINT Fd once at top of table
008	÷	-24		064	PRTX	-14	
009	*LBLA	21 11	STORE TEMP °C	065	*LBL1	21 01	
010	STOE	35 15		066	GSBC	23 13	Go to COMPUTE DELIV. CONC.
011	RTN	24		067	PRTX	-14	
012	*LBLB	21 12	ANTOINE EQUATION	068	SPC	16-11	
013	1	01		069	DSP1	-63 01	ADJUST DISPLAY AND PRINT ANSWER
014	-	-45		070	RCLC	36 13	
015	STOI	35 46	USE (i) to extract constants	071	RCLB	36 12	
016	RCLI	36 45		072	RCLA	36 11	
017	INT	16 34		073	+	-55	
018	EEX	-23		074	STOA	35 11	
019	2	02		075	PRTX	-14	
020	÷	-24		076	GT01	22 01	
021	CHS	-22		077	*LBLC	21 13	
022	RCLI	36 45		078	SF2	16 21 02	Set test-cleared flag to return from D before printing
023	FRC	16 44		079	GSBD	23 14	
024	EEX	-23		080	R↓	-31	
025	3	03		081	+	-55	By going to D, actual output can be added to Fd for more accurate %conc.
026	x	-35		082	LSTX	16-63	
027	RCLE	36 15		083	R↑	16-31	
028	PRTX	-14		084	x	-35	
029	+	-55		085	X+Y	-41	
030	÷	-24		086	÷	-24	
031	X+Y	-41		087	1	01	
032	1	01	10 x value in I will permit recall of corresponding S-reg	088	X>Y?	16-34	Is concentration less than 1%?, display more decimal places
033	0	00		089	DSP2	-63 02	
034	+	-55		090	R↓	-31	
035	STOI	35 46		091	RTN	24	
036	CLX	-51		092	*LBLD	21 14	
037	RCLI	36 45		093	7	07	
038	+	-55		094	6	06	
039	10^x	16 33		095	0	00	
040	STOD	35 14		096	x	-35	
041	PRTX	-14		097	LSTX	16-63	
042	SPC	16-11		098	RCLD	36 14	
043	RTN	24		099	-	-45	
044	*LBLk	21 16 12		100	÷	-24	
045	STOB	35 12		101	RCLD	36 14	
046	R↓	-31		102	7	07	
047	STOC	35 13	n stored for re-use in table	103	.	-62	
048	*LBL0	21 08		104	6	06	
049	GSBB	23 12		105	÷	-24	
050	RCLE	36 15		106	F2?	16 23 02	Flag 2 set? Yes - return before printing No - print results
051	RCLB	36 12		107	RTN	24	
052	+	-55		108	PRTX	-14	
053	STOE	35 15		109	R↓	-31	
054	RCLC	36 13		110	PRTX	-14	
055	GT00	22 00		111	SPC	16-11	
056	*LBLc	21 16 13		112	RTN	24	

REGISTERS

0 99420.220	1 116303.2274	2 131500.230	3 107974.222	4 133947.213	5 105926.213	6	7	8	9
S0 6.78574	S1 6.90328	S2 7.02808	S3 6.8468	S4 7.08798	S5 6.92546	S6	S7	S8	S9
A FLOW THRU VAPORIZR	B INCREMENT FLOW ΔF _v	C TEMP	D SELECTION n	E FDILUBNT	D P _v VAPOR PRESSURE	E TEMP (°C)	I USED		

Program Description I

Program Title 67 - PULMONARY MEDICINE/RESPIRATOR SETUP, DEADSPACE
ADJUSTMENT
Contributor's Name Richard C. Rodgers, M. D.
Address 2045 Oak St. Apt. 3
City San Francisco **State** Calif. **Zip Code** 94117

Program Description, Equations, Variables This program approximates the results of the Radford

nomogram, using the following formula:

$$V_A \text{ alveolar minute volume} = 10^{(C_1 \log WT(KG) + C_2)/100} \text{ ml/min.}, \text{ where}$$

For Males:

$$\begin{aligned} C &= 124 \text{ FOR WT. } \leq 8 \text{ KG} \\ &= 61 \text{ FOR WT. } > 8 \text{ KG} \end{aligned}$$

For Females:

$$\begin{aligned} C_1 &= 124 \text{ FOR WT } \leq 8 \text{ KG} \\ &= 61 \text{ FOR WT } > 8 \text{ KG BUT } \leq 23 \text{ KG} \\ &= 442 \text{ FOR WT } > 23 \text{ KG} \end{aligned}$$

$$\begin{aligned} C_2 &= 193 \text{ FOR WT. } \leq 8 \text{ KG} \\ &= 249 \text{ FOR WT. } > 8 \text{ KG} \end{aligned}$$

$$\begin{aligned} C_2 &= 193 \text{ FOR WT } \leq 8 \text{ KG} \\ &= 249 \text{ FOR WT } > 8 \text{ KG BUT } \leq 23 \text{ KG} \\ &= 272 \text{ FOR WT } > 23 \text{ KG} \end{aligned}$$

$$TV_A = \text{Alveolar tidal volume} = \frac{V_A}{r} \text{ ml, where } r = \text{breaths/minute}$$

* TV_{bas} = Basal tidal volume = $(TV_A + \beta)$ where β = wt (lbs) if no tracheostomy present, but = 1/2 wt. (lbs) if one is present.

$$TV_{corr} = TV_{bas} + (\text{mechanical deadspace}) + (\text{mandatory ventilator deadspace}) + (\text{tracheostomy deadspace, if one is present})$$

$$TV_{vent} = \text{Ventilator tidal volume} = TV_{corr} + \Delta \cdot TV_{corr}, \text{ where } \Delta = \text{corrections, as follows:}$$

Δ = sum of following

- 1) .05 ($T/{}^{\circ}\text{F}$) - 99
- 2) 2.5×10^{-5} (alt. in feet)
- 3) .10
- 4) .20

Condition

If $T(99) > 99$

*NOTE: β = upper respiratory deadspace, cc.

If patient has slight muscular activity in daytime
If metabolic acidosis is present, such as in anesthesia

Operating Limits and Warnings TV_{bas} AND ALL VALUES listed below it (see above) are interpreted slightly differently than in the Radford paper, in that the correction for tracheostomy is applied at the level of TV_{bas} rather than later, at the level of TV_{corr} . The following are the usual ranges of r based on age.:

Infants 30-50

Nomogram may not be applied with confidence to patients with abnormal lung function or muscular activity.

Children 18-30

Adults 8-18

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description I

Program Title 67-Pulmonary Medicine/Respirator Setup, Deadspace

Contributor's Name Richard C. Rodgers, M. D.

Address 2045 Oak St., Apt. 3

City San Francisco **State** CA

Zip Code 94117

Program Description, Equations, Variables The program /RS0 approximates the nomogram of SUWA et al. or deadspace required to normalize PCO₂ when the patient has a low PCO₂ (respiratory alkalosis) according to the following formula:

$$[\text{mechanical dead-space}] = \frac{40 - \text{Pa}_{\text{a}}\text{CO}_2}{40 - \alpha} \times (\text{TV}_{\text{vent}} - \text{mandatory deadspace} - \text{tracheostomy deadspace} - \text{anatomical deadspace})$$

←Starting value of PCO₂

Note that "mandatory deadspace" is that deadspace which cannot be eliminated from the ventilatory apparatus; if a tracheostomy is present, anatomical deadspace = 1/2 wt./lbs.; otherwise, it equals wt./lbs.).

$\alpha = 35$ if pulmonary function normal; otherwise

$\alpha = (\text{Pa}_{\text{a}}\text{CO}_2 - \text{P}_{\text{E}}\text{CO}_2)$ where $\text{P}_{\text{E}}\text{CO}_2 = \text{PCO}_2$ in mixed expired gas. Normal PCO₂ is assumed to be 40.

This program part does not store the resulting mech.deadspace estimate for use by the previously described program part.

Operating Limits and Warnings The original SUWA et al. paper assumed that anatomical deadspace = 2/3 wt. (lb) when a tracheostomy was present. This program thus may estimate slightly higher deadspace values when a trach. is present. The part of the program described on page 1/6 may give slightly lower estimates of TV vent than those in the original Radford paper.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

Sketch(es)

- Sample Problem(s)**
- 1) Given male, wt. = 170 lb., tracheostomy present, no activity (coma), no acidosis, sea level, body temp = 101°F, mandatory ventilator deadspace = 25 cc, added (mechanical) deadspace = 0, calculate TV_{vent} (Resp. rate = 15)
 - 2) If same pt. has $PCO_2 = 25$ later, how much deadspace should be added? Assume normal pulmonary function. Use $TV_{vent} = 442$ as calculated in problem 1 above.

Solution(s) 1) 0[A] 101[CHS][B]0[f][B]15[C]25[CHS][ENT ↑]

$$\begin{aligned} 170[\text{CHS}][f][C]0[D][f][D] &\rightarrow 442 \text{ } TV_{vent} \\ &402 \text{ } TV_{corr.} \\ &377 \text{ } TV_{bas.} \\ &292 \text{ } TV_A \\ &4377 \text{ } V_A \end{aligned}$$

$$\begin{aligned} 2) \quad 442 \text{ } [\text{CHS}][f][D] \\ 25 \text{ } [E] &\rightarrow 142 \text{ deadspace} \\ &332 \text{ } (TV_{vent} - DS) \end{aligned}$$

Reference(s) Based on 2 programs in HP-65 Library: (193, 194);

- 1) Radford, J. Appl. Physiol., 7-451 (1955)
- 2) Suwa et al., Anesthesiology, 29 = 1206 (1968).

User Instructions

PULM, MEDICINE: VENTILATOR SETUP & DEADSPACE ADJUSTMENT
 0, ACTIV. ALT. WT. TV_{vent} ABNORM. 2
 1, MET-ACID
 :MALE1:FEMALE TEMP. RES. RATE MECH. D.S. NORM.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter sides 1 & 2 of Card			
2	To calculate ventilatory tidal volume:			
	1) Input sex (0=male; 1=female)	0 or 1	A	0 or 1
	2) If & only if pt. has slight muscular function in daytime, enter "0"	0	f	0
	3) If & only if pt. is in state ov metabolic acidosis (as in anesthesia) enter "1"	1	f	1
	4) Input body temp (-°F or °C)	- °F or °C	B	°F
	5) Input altitude (m or -f)	m or -f	f	f
	6) Input respirations per minute	n(resp/m)	c	n
	7) Input either:			
	a) (Tracheostomy + Mandatory ventilator deadspace) if tracheostomy present, or	Vent DS	CHS	ENT ↑
	b) (Ventilator mand. deadsp.) if no trach &	Vent DS	ENT ↑	
	8) Input wt (Kg or - lb)	Kg or -lb	f	c
	9) Input mechanical (added) deadspace	cc	D	
	10) Calculate and display:		f	d
	1) TV_{vent}			
	2) $TV_{corr.}$			
	3) TV_{bas}			
	4) TV_a			
	5) V_a			
3	To estimate deadspace (mechanical) needed to raise PCO ₂ to 40:			
	1) Do steps 7, 8, 9 as above			
	2) Input - (TV_{vent})	- (TV_{vent})	f	TV_{vent}
	3) If pulmonary ftn normal, input PCO ₂ and calculate results :	PCO ₂	E	*
	4) If pulm ftn is abnormal, input PCO ₂ followed by PECO ₂ and calculate,	PCO ₂ , PECO ₂	f	*
	*Results displayed as: Deadspace (cc) flashing, followed by [TV_{vent} - all deadspace values], followed by deadspace in steady register.			

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	*LBL2	21 02	
002	STO1	35 46		058	CHS	-22	
003	RTN	24		059	STO4	35 04	
004	*LBLa	21 16 11		060	x	-35	
005	1	01		061	STOC	35 13	
006	X=Y?	16-33		062	*LBL3	21 03	
007	SF1	16 21 01		063	R↓	-31	
008	CLX	-51		064	X>0?	16-44	
009	X=Y?	16-33		065	GT04	22 04	
010	SF0	16 21 00		066	2	02	
011	RTN	24		067	ST÷4	35-24 04	
012	*LBLB	21 12		068	R↓	-31	
013	X<0?	16-45		069	*LBL4	21 04	
014	GT00	22 00		070	ABS	16 31	
015	1	01		071	ST05	35 05	
016	.	-62		072	RTN	24	
017	6	08		073	*LBLD	21 14	
018	x	-35		074	ST00	35 14	
019	3	03		075	RTN	24	
020	2	02		076	*LBLd	21 16 14	
021	+	-55		077	X<0?	16-45	
022	CHS	-22		078	GT06	22 06	
023	*LBL0	21 00		079	8	08	
024	CHS	-22		080	RCLC	36 13	
025	STO1	35 01		081	X≤Y?	16-35	
026	RTN	24		082	GT02	22 02	
027	*LBLb	21 16 12		083	GT01	22 45	
028	X<0?	16-45		084	*LBL0	21 00	
029	GT01	22 01		085	6	06	
030	.	-62		086	1	01	
031	3	03		087	ST0A	35 11	
032	0	00		088	2	02	
033	5	05		089	4	04	
034	÷	-24		090	9	09	
035	CHS	-22		091	ST0B	35 12	
036	*LBL1	21 01		092	GT03	22 03	
037	CHS	-22		093	*LBL1	21 01	
038	ST02	35 02		094	2	02	
039	RTN	24		095	3	03	
040	*LBLC	21 13		096	X≠Y	-41	
041	ST03	35 03		097	X≤Y?	16-35	
042	RTN	24		098	GT00	22 00	
043	*LBLc	21 16 13		099	4	04	
044	.	-62		100	4	04	
045	4	04		101	.	-62	
046	5	05		102	2	02	
047	3	03		103	ST0A	35 11	
048	6	06		104	2	02	
049	X≠Y	-41		105	7	07	
050	X<0?	16-45		106	2	02	
051	GT02	22 02		107	ST0B	35 12	
052	STOC	35 13		108	GT03	22 03	
053	X≠Y	-41		109	*LBL2	21 02	
054	÷	-24		110	1	01	
055	ST04	35 04		111	2	02	
056	GT03	22 03		112	4	04	

REGISTERS

⁰ TV _{vent}	¹ Temp (°F)	² Alt-(f)	³ Resp. Rate	⁴ ANATOMICAL DEADSPACE	⁵ TRACH VENT. D. SP	⁶ TV corr	⁷ TV _{bas}	⁸ TV _A	⁹ V _A
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A C ₁	B C ₂	C WT(KG)	D Mechanical Deadspace	E Temp.	I Sex	0=Male 1=Female			

F97 Program Listing II

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	ST0A	35 11		169	%	55	
114	1	01		170	+	-55	
115	9	09		171	ST00	35 00	
116	3	03		172	*LBL5	21 05	
117	ST0B	35 12		173	RCL0	36 00	
118	*LBL3	21 03		174	PRTX	-14	
119	RCLC	36 13		175	RCL6	36 06	
120	LOG	16 32		176	PRTX	-14	
121	RCLA	36 11		177	RCL7	36 07	
122	x	-35		178	PRTX	-14	
123	RCLB	36 12		179	RCL8	36 08	
124	+	-55		180	PRTX	-14	
125	EEX	-23		181	RCL9	36 09	
126	2	02		182	PRTX	-14	
127	÷	-24		183	R/S	51	
128	10 ^X	16 33		184	GT05	22 05	
129	ST09	35 09		185	*LBL6	21 06	
130	RCL3	36 03		186	CHS	-22	
131	÷	-24		187	RCLD	36 14	
132	ST08	35 08		188	-	-45	
133	RCL4	36 04		189	RCL4	36 04	
134	+	-55		190	-	-45	
135	ST07	35 07		191	RCL5	36 05	
136	RCL5	36 05		192	-	-45	
137	+	-55		193	ST08	35 08	
138	RCLD	36 14		194	RTN	24	
139	+	-55		195	*LBL7	21 07	
140	ST06	35 06		196	3	03	
141	RCL2	36 02		197	5	05	
142	4	04		198	*LBL8	21 08	
143	EEX	-23		199	ST0E	35 15	
144	2	02		200	R↓	-31	
145	÷	-24		201	4	04	
146	ST00	35 00		202	0	00	
147	CLX	-51		203	-	-45	
148	RCL1	36 01		204	CHS	-22	
149	9	09		205	RCL6	36 15	
150	9	09		206	÷	-24	
151	-	-45		207	RCL8	36 08	
152	X<0?	16-45		208	x	-35	
153	GT04	22 04		209	PRTX	-14	
154	5	05		210	RCL8	36 08	
155	x	-35		211	PRTX	-14	
156	ST+0	35-55 00		212	R↓	-31	
157	*LBL4	21 04		213	RTN	24	
158	CLX	-51		214	*LBL8	21 16 15	
159	1	01		215	X ^Z Y	-41	
160	0	00		216	ENT↑	-21	
161	F0?	16 23 00		217	ENT↑	-21	
162	ST+0	35-55 00		218	R↑	16-31	
163	2	02		219	-	-45	
164	x	-35		220	4	04	
165	F1?	16 23 01		221	0	00	
166	ST+0	35-55 00		222	-	-45	
167	CLX	-51		223	CHS	-22	
168	RCL0	36 00		224	GT07	22 07	

LABELS

LABELS					FLAGS	SET STATUS		
A USED	B USED	C USED	D USED	E USED	0 USED	FLAGS	TRIG	DISP
a USED	b USED	c USED	d USED	e USED	1 USED	ON OFF	DEG	FIX
c USED	1 USED	2 USED	3 USED	4 USED	2 USED	1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
5 USED	6 USED	7 USED	8 -----	9 -----	3 NOT USED	2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input checked="" type="checkbox"/>	n 0	

Program Description I

Program Title 67 - COPPER KETTLE ANESTHETIC REGULATION

Contributor's Name Richard C. Rodgers, M. D.

Address 2045 Oak St. # 3

City San Francisco State Calif.

Zip Code 94117

Program Description, Equations, Variables Given anesthetic circuit =

Where: F_T = Total gas flow to patient circuit

F_K = Flow out of vaporizer = $F_V + F_A$

F_R = Flow into vaporizer ($O_2 + N_2O$)

F_A = Flow of anesthetic out of vaporizer

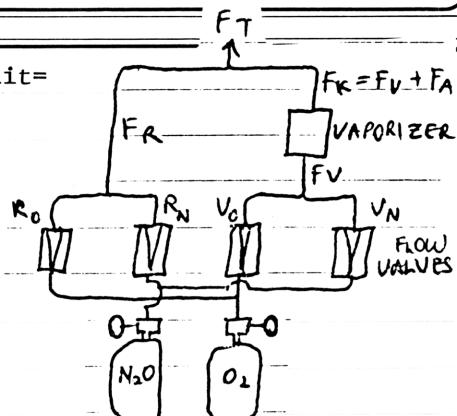
$F_R = F_T - F_K$ = remainder flow

R_O = Remainder flow of oxygen

R_N = Remainder flow of N_2O

V_O = Vaporizer flow of oxygen

V_N = Vaporizer flow of N_2O



A = Anesthetic, by %, desired in final mixture of gases (F_t) then, the value of

F_V required to provide $A\%$ of anesthetic is: $F_V = (P_A/PV) \cdot F_T \cdot (A/100)$ Where

P_A = Atmospheric pressure

PV = Partial pr. of anesthetic

Atmos. pr. can be estimated by: $P_A = 760.938 \cdot e^{-1.2421 \times 10^{-4}}$, (meters altitude)

which is obtained as an exponential fit to the ICAO STD. atmosphere table

(reference No. 1). The mg/ml anesthetic in final gas mix = $W =$

(gram molecular weight) · PA · (A/100)

$(273.15 + {}^\circ C) \cdot 62.359$

Anesthetic liquid usage rate (min/ml) = (specific gravity of liquid, gm/ml) · 1000

Gibbs correction of P_V for P_A is: $P_V (\text{correction}) = \exp \left\{ \frac{\frac{W \cdot F_T}{\text{molecular weight}} \cdot 1000}{\frac{\text{specific grav.} \cdot 1000}{(O_K) \cdot 6.236 \times 10^4} \cdot (P_A - 760) + \ln(P_V)} \right\}$

$F_K = F_V + F_A = \left(\frac{P_V + P_A}{P_A} \right) \cdot F_V, S_O = F_R = F_T - \left(\frac{P_V + P_A}{P_A} \right) \cdot F_V$

Also: P_V is calculated from the Antoine equation as: $\log P_V = A' - \frac{B}{T(K) + C}$, where A' (not to be confused with A , above), B & C are constants for a given anesthetic agent.

Operating Limits and Warnings: The maximal value of A attainable is: $A_{MAX} = PV / (P_A + P_V)$. If this is exceeded by the operator, A_{MAX} will be displayed, flashing, when one attempts to compute F_V .

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

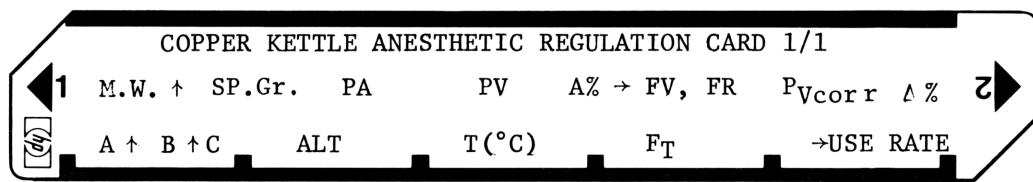
Sketch(es)

Sample Problem(s) Given the Antoine constants for enflurane, or $A=6,98840$ $B=1107.839$, and $C=213.063$; at an altitude of 4500 feet, at 25°C , given $F_T = 3000 \text{ cc/min}$ and $A=3\%$ (for induction purposes). Mol wt. of enflurane = 184.5, Spec. gravity = 1.52.

Solution(s) $6.9884[\text{ENT} \uparrow]1107.839[\text{ENT} \uparrow] 213.063[\text{A}] 184.5[\text{ENT} \uparrow] 1.52[\text{f}][\text{A}]$
 $4500[\text{CHS}][\text{B}] \rightarrow 641.84 \text{ Pa, mm Hg}$
 $25[\text{C}] \rightarrow 216.20 \text{ P}_V, \text{ mm Hg}$
 $3000[\text{D}] 3[\text{f}][\text{D}] \rightarrow 267.19 \text{ F}_V, \text{ cc/min.}$
 $[\text{R/S}] \rightarrow 2642.81 \text{ F}_R \text{ cc/min.}$
 $[\text{R/S}] \rightarrow 25.20 \text{ Amax \%}$
 $[\text{E}] \rightarrow 2.65 \text{ USE RATE, min/ml. } [\text{R/S}] \rightarrow 0.19 \text{ mg/ml}$
 $[\text{f}][\text{E}] \rightarrow 216.20 \text{ P}_V \text{ corr., mm Hg. } [\text{R/S}] \rightarrow 7.710629327-05$
 Correction is always minute in practice, showing rigorous nature of Dalton's law of partial pressures!

Reference(s) 1) Scientific Tables, Diem & Lentner, Documenta Geigy, 7th Edition, Basle (Switz.), 1972, page 252
 2) Rodgers, R. C. & G. E. Hill, in prep. (1976)

User Instructions



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	If Antoine constants are to be entered automatically from card, input side 1 of card of any of the specific agent cards written by present author.			
		Author		
2	Enter card (both sides) "Copper Kettle"			
3	If #1 not done, input A', B, & C.	A'	ENT ↑	
		B	ENT ↑	
		C	A	
4	If #1 not done, input mol. wt. & specific gravity of volatile agent	M.W.	ENT ↑	
		SP. GRAV.	f A	M. W.
5	Do either:			
	a. Input altitude in meters or -feet to estimate atmospheric pr. P _A	m, -f	B	P _A (mm Hg)
	b. Input barometric P _A mm Hg	P _A	f B	P _A (mm Hg)
6	Do either: **			
	a. Unit T (°C) to calculate vapor pressure	T(C°)	C	Pv (mm Hg)
	b. Input vapor pressure of anesthetic directly.	mm/Hg	f C	Pv (mm Hg)
7	Input total flow to patient circuit	F _t	D	F _t (cc/min)
8	Input A, % of anesthetic vapor desired in final mixture, calculate FV (flow to vaporizer)	A(%)	f D	Fv (cc/min)
9	Display F _R (remainder flow)*		R/S	F _R (cc/min)
10	Calculate ml/ml of LIQUID ANESTHETIC (USE RATE)		E	ml/ml
11	To calculate time remaining, input ml. agent left & press X (optional)	ml	x	min.
12	To calculate mg of anesth.vapor per ml final gas mix:		R/S	mg/ml
13	To calculate Gibbs - corrected value of P _V for P _A ;			Pv (corr.)
14	To calculate % CH from Pv (corr) to Pv		R/S	% corr.
15	May change data entered in any steps, and redo Steps 8-14 at will			
*16	May display A _{MAX} after Step 9		R/S	A _{MAX}
**17	If P _V ≥ P _A (i.e., anesthetic is a gas at a given T) program will stop and flash P _A			

97 Program Listing I

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	10 ^x	16 33	
002	ST02	35 02		058	*LBLc	21 16 13	
003	R↓	-31		059	RCL5	36 05	
004	ST01	35 01		060	X>Y?	16-34	See if PV ≥ PA
005	R↓	-31		061	GT05	22 05	
006	ST00	35 00		062	*LBL4	21 04	
007	RTN	24		063	PSE	16 51	Display flashing
008	*LBLa	21 16 11		064	GT04	22 04	"PA"
009	ST04	35 04		065	*LBL5	21 05	
010	R↓	-31		066	X#Y	-41	
011	ST03	35 03		067	ST06	35 06	P_V → (6)
012	RTN	24		068	PRTX	-14	
013	*LBLB	21 12		069	RTN	24	
014	X>0?	16-44		070	*LBLD	21 14	
015	GT01	22 01		071	ST07	35 07	
016	CHS	-22		072	RTN	24	FT → (7)
017	.	-62		073	*LBLd	21 16 14	
018	3	03		074	RCL6	36 06	
019	0	00		075	RCL5	36 05	
020	4	04		076	RCL6	36 06	
021	8	08		077	+	-55	
022	X	-35		078	÷	-24	
023	*LBL1	21 01		079	EEX	-23	
024	1	01	Alt. is now in meters	080	2	02	
025	.	-62		081	X	-35	
026	2	02		082	X#Y	-41	
027	4	04		083	X>Y?	16-34	
028	1	01		084	GT02	22 02	
029	CHS	-22		085	EEX	-23	
030	EEX	-23		086	2	02	
031	4	04		087	÷	-24	
032	CHS	-22		088	ST09	35 09	(A/100) → (9)
033	X	-35		089	RCL5	36 05	
034	e ^x	33		090	X	-35	
035	7	07		091	RCL6	36 06	
036	6	06		092	÷	-24	
037	0	00		093	RCL7	36 07	
038	.	-62		094	X	-35	
039	9	09		095	PRTX	-14	
040	3	03		096	R/S	51	
041	8	08		097	RCL5	36 05	
042	X	-35		098	RCL6	36 06	
043	PRTX	-14		099	+	-55	
044	*LBLb	21 16 12		100	RCL5	36 05	
045	ST05	35 05		101	÷	-24	
046	RTN	24		102	X	-35	
047	*LBLC	21 13		103	RCL7	36 07	
048	ST08	35 08		104	-	-45	
049	RCL2	36 02		105	CHS	-22	
050	+	-55		106	PRTX	-14	
051	RCL1	36 01		107	R/S	51	F_R in X
052	X#Y	-41		108	R↓	-31	
053	÷	-24		109	PRTX	-14	
054	RCL0	36 00		110	RTN	24	
055	-	-45		111	*LBL2	21 02	A _{MAX} in X
056	CHS	-22		112	X#Y	-41	

REGISTERS

0	A'	1	B	2	C	3	MOL-WT	4	SPEC- GRAV.	5	PA	6	P _V	7	F _T	8	T(°C)	9	A/100
S0	S1			S2		S3		S4		S5	S6		S7		S8		S9		
A	T(°K)	B	W	C		D		E		F	G	H	I	J	K	L	M	N	

97 Program Listing II

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	*LBL3	21 03		169	.	-62	
114	PSE	16 51		170	2	02	
115	GT03	22 03	"A _{MAX} "	171	3	03	
116	*LBL4	21 15		172	6	06	
117	RCL3	36 03		173	EEX	-23	
118	RCL5	36 05		174	4	04	
119	x	-35		175	÷	-24	
120	RCL9	36 09		176	RCL6	36 06	
121	x	-35		177	LN	32	
122	RCL8	36 08		178	+	-55	
123	2	02		179	e ^x	33	
124	7	07		180	PRTX	-14	Display P _V (corr.)
125	3	03		181	R/S	51	
126	.	-62		182	RCL6	36 06	
127	1	01		183	%CH	16 55	
128	5	05		184	PRTX	-14	
129	+	-55		185	RTN	24	
130	STO A	35 11		186	R/S	51	
131	÷	-24	(°K) → (A)	190			
132	6	06		200			
133	2	02		210			
134	.	-62		220			
135	3	03					
136	5	05					
137	9	09					
138	÷	-24					
139	STO B	35 12					
140	RCL7	36 07	W = (mg/ml) of vapor → (B)				
141	x	-35					
142	EEX	-23					
143	3	03					
144	X ² Y	-41					
145	÷	-24					
146	RCL4	36 04					
147	x	-35					
148	PRTX	-14					
149	R/S	51					
150	RCLB	36 12					
151	PRTX	-14					
152	RTN	24					
153	*LBL4	21 16 15					
154	RCL3	36 03					
155	RCL4	36 04					
156	÷	-24					
157	EEX	-23					
158	3	03					
159	÷	-24					
160	RCL5	36 05					
161	7	07					
162	6	06					
163	0	00					
164	-	-45					
165	x	-35					
166	RCLA	36 11					
167	÷	-24					
168	6	06					

LABELS

FLAGS

SET STATUS

A'↑	B↑C	B-f } PA	C T(°C)→ P _V	D F _t	E min/ml mg/ml	0	FLAGS	TRIG	DISP
a MW ↑ S.G.	b PA	c P _V	d A → F _V F _A A _{AN}	e P _V corr% Δ ¹			ON OFF		
0	1 Used	2 Used	3 Used	4 Used	2		0 <input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
5 Used	6	7	8	9	3		1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
							2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
							3 <input type="checkbox"/> <input checked="" type="checkbox"/>		n 2

Program Description I

Program Title 67 - ANESTHESIA: ANTOINE VALUES FROM EXPERIMENTAL DATA

Contributor's Name Richard C. Rodgers, M. D.

Address 2045 Oak St. #3

City San Francisco

State Calif.

Zip Code 94117

Program Description, Equations, Variables The Antoine equation uses the 3 constants A, B, &

C to express vapor pressure (P_V) as a function of temperature (T , °C) =

$$\log(P_V) = A - \frac{B}{T+C}$$

This can be changed to:

$$T \cdot \log(P_V) = A \cdot T + (-C) \log(P_V) + (AC-B)$$

which is of the form $Z = a_0 + a_1x + a_2y$ or a multiple linear regression formula, with $Z = T \cdot \log(P_V)$, $y = \log(P_V)$ and $X = T(\text{°C})$. This program calculates A, B & C on the basis of such a multiple linear regression.

Operating Limits and Warnings

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

Sketch(es)

(This section is currently empty.)

Sample Problem(s)

1) T (°C)	P _V /mm Hg
17.3	151.2
28.3	250.1
36.2	349.4
42.4	449.5
47.8	551.2
52.2	649.3
56.4	752.9

- 2) Given T = 17.3, estimate P_V from equation.

Solution(s)

1) 17.3[E] 151.2[A] 28.3[E] 250.1[A] 36.2[E] 349.4[A] 42.4[E] 449.5[A] 47.8[E] 551.2[A] 52.2[E] 649.3[A] 56.4[E] 752.9[A] → 7
[D] → 6.98840 A
[R/S] → 1107.839B
[R/S] → 213.063 C

- 2) 17.3[E] → 151.11 T(°C) approx.

Reference(s)

(This section is currently empty.)

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 16 11		057	-	-45	
002	CLRG	16-53		058	RCL2	36 02	
003	F#S	16-51		059	RCL9	36 09	
004	CLRG	16-53		060	X	-35	
005	RTN	24		061	RCL6	36 06	
006	*LBLA	21 11		062	RCL1	36 01	
007	DSP2	-63 02		063	X	-35	
008	LOG	16 32		064	-	-45	
009	GSBe	23 16 15		065	X	-35	
010	ST+1	35-55 01		066	STO1	35 14	
011	RCLB	36 12		067	RCL8	36 08	
012	X	-35		068	RCL9	36 09	
013	ST+2	35-55 02		069	X	-35	
014	RCLA	36 11		070	RCL4	36 04	
015	RCLC	36 13		071	RCL6	36 06	
016	X	-35		072	X	-35	
017	ST+3	35-55 03		073	-	-45	
018	RCLB	36 12		074	RCL3	36 03	
019	RCLA	36 11		075	RCL9	36 09	
020	Σ^+	56		076	X	-35	
021	RTN	24		077	RCL4	36 04	
022	*LBLB	21 12		078	RCL1	36 01	
023	LOG	16 32		079	X	-35	
024	*LBL1	21 01		080	-	-45	
025	GSBe	23 16 15		081	X	-35	
026	ST-1	35-45 01		082	STO1	35 15	
027	RCLB	36 12		083	RCL5	36 05	
028	X	-35		084	RCL9	36 09	
029	ST-2	35-45 02		085	X	-35	
030	RCLA	36 11		086	RCL4	36 04	
031	RCLC	36 13		087	X ²	53	
032	X	-35		088	-	-45	
033	ST-3	35-45 03		089	RCL9	36 09	
034	RCLB	36 12		090	RCL7	36 07	
035	RCLA	36 11		091	X	-35	
036	Σ^-	16 56		092	RCL6	36 06	
037	RTN	24		093	X ²	53	
038	*LBLC	21 13		094	-	-45	
039	RCLA	36 11		095	X	-35	
040	RCLB	36 12		096	RCL8	36 08	
041	GT01	22 01		097	RCL9	36 09	
042	*LBLD	21 14		098	X	-35	
043	RCL3	36 03		099	RCL4	36 04	
044	RCL2	36 02		100	RCL6	36 06	
045	RCL1	36 01		101	X	-35	
046	F#S	16-51		102	-	-45	
047	ST01	35 01		103	X ²	53	
048	R↓	-31		104	-	-45	
049	ST02	35 02		105	RCLD	36 14	
050	R↓	-31		106	RCL8	36 15	
051	ST03	35 03		107	-	-45	
052	RCL5	36 05		108	X#Y	-41	
053	RCL9	36 09		109	÷	-24	
054	X	-35		110	CHS	-22	
055	RCL4	36 04		111	STO1	35 46	
056	X ²	53		112	RCL3	36 03	

REGISTERS

0	1 Σz	2 Σyz	3 Σxz	4 Σx	5	6	7	8	9
S0	S1	S2	S3	S4 Σx	S5 Σx^2	S6 Σy	S7 Σy^2	S8 Σxy	S9 n
A LST X	B LST y	C LST Z	D A	E B	F	G	H	I C	J

97 Program Listing II

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	RCL9	36 09		169	÷	-24	
114	x	-35		170	RCLD	36 14	
115	RCL4	36 04		171	-	-45	
116	RCL1	36 01		172	CHS	-22	
117	x	-35		173	10 ^X	16 33	
118	-	-45		174	DSP2	-63 02	
119	RCL8	36 08		175	RTN	24	
120	RCL9	36 09		176	*LBL#e	21 16 15	
121	x	-35		177	STOB	35 12	
122	RCL4	36 04		178	X#Y	-41	
123	RCL6	36 06		179	STOA	35 11	
124	x	-35		180	x	-35	
125	-	-45		181	STOC	35 13	
126	RCL1	36 01		182	RTN	24	
127	x	-35		183	R/S	51	
128	+	-55					
129	RCL5	36 05					
130	RCL9	36 09					
131	x	-35					
132	RCL4	36 04					
133	X ²	53					
134	-	-45		190			
135	÷	-24					
136	STOD	35 14					
137	RCL4	36 04					
138	x	-35					
139	RCL1	36 01					
140	CHS	-22					
141	RCL6	36 06					
142	x	-35					
143	+	-55					
144	RCL1	36 01		200			
145	-	-45					
146	CHS	-22					
147	RCL9	36 09					
148	÷	-24					
149	RCLD	36 14					
150	RCL1	36 01					
151	x	-35					
152	CHS	-22					
153	+	-55		210			
154	CHS	-22					
155	STOE	35 15					
156	RCLD	36 14					
157	DSP5	-63 05					
158	R/S	51					
159	RCL6	36 06					
160	DSP3	-63 03					
161	R/S	51					
162	RCL1	36 01					
163	RTN	24					
164	*LBL#e	21 15		220			
165	RCL1	36 01					
166	+	-55					
167	RCL6	36 06					
168	X#Y	-41					

LABELS

FLAGS

SET STATUS

A Used	B Used	C Used	D Used	E Used	0	FLAGS	TRIG	DISP
a Used	b	c	d	e Used	1	ON OFF	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
0	1	2	3	4	2	1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
5	6	7	8	9	3	2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input checked="" type="checkbox"/>		n <u>2</u>

VAPOR PRESSURE PROGRAM COMMENTS

The remaining nine programs in this collection calculate vapor pressure at a desired temperature and Gibbs - corrected vapor pressure for specific compounds of interest to anesthesiologists. With one exception*, they all employ an identical program for the calculation. However, different constants must be stored in the calculator memory registers for each different compound.

The user may wish to make a separate card for each compound with the data stored on one side of the card and the program on the other, or he may wish to record the program once on a single side of a card and employ separate data cards for the constants for each compound (two compounds to a card). In either case, the program need only be keyed in once, the program card(s) recorded and data recorded by storing the constants in the registers as shown in the Register Contents listings.

*The exception is the program for cyclopropane, which does not contain the routine for the Gibbs - corrected vapor pressure since its boiling point, (33°C), below named ambient temperature. This 51-step program is identical with the first 51 steps of the other vapor pressure programs.

Program Description I

Program Title 67 - ANESTHESIA: VAPOR PRESSURE OF WATER (RODGERS)

Contributor's Name Richard C. Rodgers, M. D.

Address 2045 Oak Street, Apt. 3

City San Francisco **State** CA

Zip Code 94117

Program Description, Equations, Variables The vapor pressure of water can be expressed by an Antoine equation:

$$\log_{10} P \text{ (mm Hg)} = 8.04343 - \frac{1716.984}{T(\text{°C}) + 232.538}$$

Atmospheric pressure may be input directly or estimated on the basis of Altitude As z^2 :

$$P_A \text{ (mm Hg)} = 760.938 \cdot e^{-1.241 \times 10^{-4} z^2} \text{ (alt. in meter)}$$

The Gibbs - corrected P_V value is:

$$P_V \text{ (corr.)} = \exp \left\{ \frac{\text{mol. wt.}}{\text{spec. grav.} \cdot 1000} \frac{(P_A - 760)}{(\text{°K}) \cdot 6.236 \times 10^4} + \ln (P_V) \right\}$$

Operating Limits and Warnings Antoine constants were fit to data from -5 to 135°C, and calculated values deviate from the data by < 1%.

When preparing recorded magnetic card, constants for storage in registers are loaded on Side 1, Program on Side 2.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

Sketch(es)
Sample Problem(s)

- 1) $T = 0^\circ\text{C}$, find P_V
- 2) $T = 80^\circ\text{C}$, Find P_V
- 3) Altitude = 4500 feet, find P_A
- 4) Altitude = 1000 meters, find P_A
- 5) Calculate $P_{V \text{ corr}} + \% \text{ correction for } 35^\circ\text{C and 2500 feet altitude.}$

- Solution(s)**
- 1) $0[A] \rightarrow 4.57 \text{ mm Hg, [R/S]} \rightarrow 0.01 \text{ Atm.}, P_V$
 - 2) $80[A] \rightarrow 354.61 \text{ mm Hg, [R/S]} \rightarrow 0.47 \text{ Atm.}, P_V$
 - 3) $4500[\text{CHS}][B] \rightarrow 641.84 \text{ mm Hg, } P_A$
 - 4) $1000[B] \rightarrow 672.13 \text{ mm Hg, } P_A$
 - 5) $35[A]2500[\text{CHS}][B][C] \rightarrow 42.24 \text{ mm Hg, } P_{V \text{ corr.}}$
 $[R/S] \rightarrow 6.439602080-06, \% \text{ corr.}$

- Reference(s)**
- 1) Rodgers R. C. & G. E. Hill, in Prep., 1976
 - 2) ICAO Std. Atm. Table, in SCIENTIFIC TABLES, Diem & Lentner CIBA-Geigy, Basle, 1972, page 252

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	÷	-24	
002	ST07	35 07		058	EEX	-23	
003	ROL2	36 02	T(°C) → (7)	059	3	03	
004	+	-55		060	÷	-24	
005	ROL1	36 01		061	ROL5	36 05	
006	X>Y	-41		062	7	07	
007	÷	-24		063	6	06	
008	ROL0	36 00		064	0	00	
009	-	-45		065	-	-45	
010	CHS	-22		066	X	-35	
011	10^X	16 33		067	ROL7	36 07	
012	ST06	35 06	P _V → (6)	068	2	02	
013	R/S	51		069	7	07	
014	7	07		070	3	03	
015	6	06		071	.	-62	
016	0	00		072	1	01	
017	÷	-24		073	5	05	
018	RTN	24	Display atm.	074	+	-55	
019	*LBLB	21 12		075	÷	-24	
020	X>0?	16-44		076	6	06	
021	GT01	22 01		077	.	-62	
022	CHS	-22		078	2	02	
023	.	-62		079	3	03	
024	3	03		080	6	06	
025	0	00		081	EEX	-23	
026	4	04		082	4	04	
027	8	08		083	÷	-24	
028	X	-35		084	ROL6	36 06	
029	*LBL1	21 01	Alt.(in meters) now	085	LN	32	
030	1	01		086	+	-55	
031	.	-62		087	e^	33	
032	2	02		088	R/S	51	
033	4	04		089	ROL6	36 06	Display P _V (corr.)
034	1	01		090	XCH	16 55	
035	CHS	-22		091	RTN	24	
036	EEX	-23		092	R/S	51	Display % corr.
037	4	04					
038	CHS	-22					
039	X	-35					
040	e^X	33					
041	7	07					
042	6	06					
043	0	00					
044	.	-62					
045	9	09					
046	3	03					
047	8	08					
048	X	-35					
049	ST05	35 05	P _A → (5)				
050	RTN	24					
051	*LBL6	21 16 12					
052	ST05	35 05					
053	RTN	24					
054	*LBLC	21 13					
055	ROL3	36 03					
056	ROL4	36 04					

REGISTERS								
0 8.04343	1 1716.984	2 232.538	3 18.02	4 1,000	5 P _A	6 P _V	7 T(°C)	8 I S8 S9
S0	S1	S2	S3	S4	S5	S6	S7	
A	B	C	D	E	F	G	H	I

Program Description I

Program Title 67 - ANESTHESIA: VAPOR PRESSURE OF HALOTHANE

Contributor's Name Richard C. Rodgers, M. D.

Address 2045 Oak Street, Apt. 3

City San Francisco **State** CA

Zip Code 94117

Program Description, Equations, Variables The vapor pressure of halothane can be described by an Antoine equation:

$$\log P \text{ (mm Hg)} = 6.76799 - \frac{1043.697}{T(\text{°C})+218.262}$$

Atmospheric pressure may be input directly or estimated on the basis of altitude as:

$$P_A \text{ (mm Hg)} = 760.938 \cdot e^{-1.241 \cdot 10^{-4} \text{ (alt. in meter)}}$$

The Gibbs - corrected P_V value is:

$$P_V \text{ (corrected)} = \exp \left\{ \frac{\frac{\text{mol wt.}}{\text{spec. grav.} \cdot 1000} (P_A - 760) + \ln (P_V)}{(0_K) \cdot 6.23 \times 10^4} \right\}$$

Operating Limits and Warnings Antoine constants were fit to data from -50 to 56°C, and calculated values deviate from the data by < 3% (< 1% for T > - 40°C).

When preparing recorded magnetic card; constants for storage in registers are loaded on Side 1, Program on Side 2.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

Sketch(es)
Sample Problem(s)

- 1) $T = 50^\circ\text{C}$, find P_V
- 2) $T = 20^\circ\text{C}$
- 3) Given altitude = 4500 ft., find P_A
- 4) Given altitude = 1000 m., find P_A
- 5) Calculate P_V corr & % corr for halothane at 35°C , 2500 ft.

Solution(s) 1) $50[\text{A}] \rightarrow 754.05 \text{ mm Hg}$, $[\text{R/S}] \rightarrow 0.99 \text{ Atm. } (P_V)$

2) $20[\text{A}] \rightarrow 244.08 \text{ mm Hg}$, $[\text{R/S}] \rightarrow 0.32 \text{ Atm. } (P_V)$

3) $4500[\text{CHS}][\text{B}] \rightarrow 641.84 \text{ mm Hg } (P_A)$

4) $1000[\text{B}] \rightarrow 672.13 \text{ mm Hg } (P_A)$

5) $35[\text{A}] 2500[\text{CHS}][\text{B}][\text{C}] \rightarrow 443.58 \text{ mm Hg } (P_V \text{ corr})$

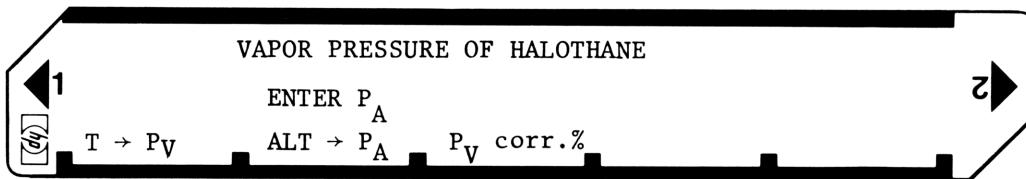
$[\text{R/S}] \rightarrow 3.740016511 - 05\% \text{ corr.}$

Reference(s)

- 1) Rodgers, R. C. & G. E. Hill, in preparation (1976).
- 2) ICAO Std. atm. table, in SCIENTIFIC TABLES, Diem & Lentner, CIBA -, Geigy, Basle (1972), page 252.

User Instructions

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STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Side 1 of card to store constants for use with "copper kettle anesthesia regulation" program if desired.			
2	Use "copper kettle anesthesia regulation" program as desired. or			
1'	Load sides 1 & 2			
2'	Input temp. & calculate vapor pressure Optional: Convert Pv to Atm.	T, °C	A R/S	Pv, (mm Hg) Pv, (Atm.)
3'	Do either: a) Input altitude (meters +, or feet-) b) Input atm. pressure from barometer	M, or-Ft PA, mmHg	B f C	PA (mm Hg) PA (mm Hg) Pv (corr.)
4'	Calculate Gibbs - corrected Pv		R/S	% corr.
5'	Calculate % correction			
NOTE: When preparing recorded magnetic card from program register listings on following pages perform the following steps:				
1	Load registers 0 through 4 with constants shown.			
2	With calculator in "run" mode press "write data" key & pass side 1 of blank card through card reader.			
3	Record program on Side 2 of card in usual manner.			
SET STATUS				
FLAGS TRIG DISP				
ON OFF				
0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	n 2

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	÷	-24	
002	ST07	35 07		058	EEX	-23	
003	RCL2	36 02		059	3	03	
004	+	-55	T(°C) → (7)	060	÷	-24	
005	RCL1	36 01		061	RCL5	36 05	
006	X#Y	-41		062	7	07	
007	÷	-24		063	6	06	
008	RCL0	36 00		064	0	00	
009	-	-45		065	-	-45	
010	CHS	-22		066	X	-35	
011	10X	16 33		067	RCL7	36 07	
012	ST06	35 06	Pv → (6)	068	2	02	
013	R/S	51		069	7	07	
014	7	07	Display mm Hg	070	3	03	
015	6	06		071	.	-62	
016	0	00		072	1	01	
017	÷	-24		073	5	05	
018	RTN	24		074	+	-55	
019	*LBLB	21 12	Display (atm.)	075	÷	-24	
020	X>0?	16-44		076	6	06	
021	GT01	22 01		077	.	-62	
022	CHS	-22		078	2	02	
023	.	-62		079	3	03	
024	3	03		080	6	06	
025	0	00		081	EEX	-23	
026	4	04		082	4	04	
027	8	08		083	÷	-24	
028	X	-35		084	RCL6	36 06	
029	*LBL1	21 01		085	LN	32	
030	1	01		086	+	-55	
031	.	-62	Alt. in meters now	087	e ^x	33	
032	2	02		088	R/S	51	
033	4	04		089	RCL6	36 06	Display Pv(com.)
034	1	01		090	%CH	16 55	
035	CHS	-22		091	RTN	24	Display % CH.
036	EEX	-23		092	R/S	51	
037	4	04					
038	CHS	-22					
039	X	-35					
040	e ^x	33					
041	7	07					
042	6	06					
043	0	00					
044	.	-62					
045	9	09					
046	3	03					
047	8	08					
048	X	-35					
049	ST05	35 05					
050	RTN	24					
051	*LBLb	21 16 12	P _A → (5)				
052	ST05	35 05					
053	RTN	24					
054	*LBLc	21 13	P _A → (5)				
055	RCL3	36 03					
056	RCL4	36 04					

REGISTER COMMENTS

6.767990000 0
1043.697000 1
218.2620000 2
197.4000000 3
1.860000000 4
0.000000000 5
0.000000000 6
0.000000000 7
0.000000000 8
0.000000000 9

REGISTERS

⁰ 6.76799	¹ 1043.697	² 218.262	³ 197.4	⁴ 1.86	⁵ P _A	⁶ P _y	⁷ T(°C)	⁸	⁹
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E			I		

Program Description I

Program Title 67 - Anesthesia: Vapor pressure of diethyl ether

Contributor's Name Richard C. Rodgers, M. D.

Address 2045 Oak Str., Apt. 3

City San Francisco **State** CA

Zip Code 94117

Program Description, Equations, Variables The vapor pressure of diethyl ether can be described by an Antoine equation:

$$\log P \text{ (mm/Hg)} = 7.02683 - \frac{1109.577}{T(\text{°C}) + 233.155}$$

Atmospheric pressure may be input directly or estimated on the basis of altitude as

$$P_A \text{ (mm/Hg)} = 760.938 \cdot e^{-1.24 \times 10^{-4} \text{ (alt. in meters)}}$$

The Gibbs - corrected P_V value is:

$$P_V \text{ (corrected)} = \exp \left\{ \frac{\text{mol wt.}}{\text{spec grav} \cdot 1000} \frac{(P_A - 760)}{(\text{oK}) \cdot 6.236 \times 10^4} + \ln(P_V) \right\}$$

Operating Limits and Warnings Antoine constants were fit to data from -100 to 50°C, and calculated values deviate from data by < .7%.

When preparing magnetic card; constants for storage in registers are loaded on Side 1, Program on Side 2.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

Sketch(es)

Sample Problem(s)

- 1) $T = 30^\circ\text{C}$, find P_V
- 2) $T = 10^\circ\text{C}$, find P_V
- 3) Given altitude = 4500 ft. find P_A
- 4) Given altitude = 1000 m, find P_A
- 5) Calculate P_V corr. for 35°C and 2500 feet alt.

Solution(s)

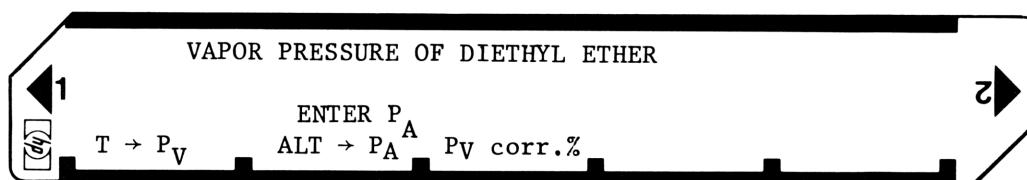
- 1) $30[A] \rightarrow 646.24 \text{ mm Hg}$, [R/S] $\rightarrow 0.85 \text{ Atm.}$, P_V
- 2) $10[A] \rightarrow 290.79 \text{ mm Hg}$,
[R/S] $\rightarrow 0.38 \text{ Atm.}$, P_V
- 3) $4500[\text{CHS}][B] \rightarrow 641.84 \text{ mm Hg}$, P_A
- 4) $1000[B] \rightarrow 672.13 \text{ mm Hg}$, P_A
- 5) $35[A] 2500[\text{CHS}][B][C] \rightarrow 774.48 \text{ mmHg}$, P_V corr.
[R/S] $\rightarrow 3.632113697-05$, % corr.

Reference(s)

- 1) Rodgers, R. C., & G. E. Hill, in Prep. (1976)
- 2) ICAO Std. Atm. Table, in Scientific Tables, Diem & Lentner, Ciba Geigy, Basle (1972), page 252.

User Instructions

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STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Side 1 of card to store constants for use with "copper kettle anesthesia regulation" program if desired.			
2	Use "copper kettle anesthesia regulation" program as desired. or			
1'	Load sides 1 & 2			
2'	Input temp. & calculate vapor pressure Optional: Convert P_V to Atm.	$T, {}^{\circ}\text{C}$	A R/S	$P_V, (\text{mm Hg})$ $P_V, (\text{Atm.})$
3'	Do either: A) Input altitude (meters +, or feet-) m, or-Ft B) Input atm. pressure from barometer $P_A, \text{mm Hg}$		B f C R/S	$P_A (\text{mm Hg})$ $P_A (\text{mm Hg})$ $P_V (\text{corr.})$ % corr.
4'	Calculate Gibbs - corrected P_V			
5'	Calculate % correction			
NOTE: When preparing recorded magnetic card from program register listings on following pages perform the following steps:				
1	Load registers 0 through 4 with constants shown.			
2	With calculator in "run" mode press "write data" key and pass Side 1 of blank card through card reader.			
3	Record program on Side 2 of card in usual manner.			
SET STATUS				
FLAGS TRIG DISP				
ON OFF		DEG <input checked="" type="checkbox"/>		FIX <input checked="" type="checkbox"/>
0 <input type="checkbox"/> <input checked="" type="checkbox"/>		GRAD <input type="checkbox"/>		SCI <input type="checkbox"/>
1 <input type="checkbox"/> <input checked="" type="checkbox"/>		RAD <input type="checkbox"/>		ENG <input type="checkbox"/>
2 <input type="checkbox"/> <input checked="" type="checkbox"/>				n <u>2</u>
3 <input type="checkbox"/> <input checked="" type="checkbox"/>				

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	÷	-24	
002	ST07	35 07		058	EEX	-23	
003	RCL2	36 02		059	3	03	
004	+	-55		060	÷	-24	
005	RCL1	36 01		061	RCL5	36 05	
006	X#Y	-41		062	7	07	
007	÷	-24		063	6	06	
008	RCL0	36 00		064	0	00	
009	-	-45		065	-	-45	
010	CHS	-22		066	x	-35	
011	10^	16 33		067	RCL7	36 07	
012	ST06	35 06	P _V → (6)	068	2	02	
013	R/S	51		069	7	07	
014	7	07	Display mm/tg	070	3	03	
015	6	06		071	.	-62	
016	0	00		072	1	01	
017	÷	-24		073	5	05	
018	RTN	24		074	+	-55	
019	*LBLB	21 12	Display Atm.	075	÷	-24	
020	X>0?	16-44		076	6	06	
021	GT01	22 01		077	.	-62	
022	CHS	-22		078	2	02	
023	.	-62		079	3	03	
024	3	03		080	6	06	
025	0	00		081	EEX	-23	
026	4	04		082	4	04	
027	8	08		083	÷	-24	
028	x	-35		084	RCL6	36 06	
029	*LBL1	21 01	Alt. in meters now	085	LN	32	
030	1	01		086	+	-55	
031	.	-62		087	e ^x	33	
032	2	02		088	R/S	51	
033	4	04		089	RCL6	36 06	
034	1	01		090	ZCH	16 55	
035	CHS	-22		091	RTN	24	
036	EEX	-23		092	R/S	51	
037	4	04					
038	CHS	-22					
039	x	-35					
040	e ^x	33					
041	7	07					
042	6	06					
043	0	00					
044	.	-62					
045	9	09					
046	3	03					
047	8	08					
048	x	-35					
049	ST05	35 05	P _A → (5)				
050	RTN	24					
051	*LBL6	21 16 12					
052	ST05	35 05					
053	RTN	24					
054	*LBLC	21 13	P _A → (5)				
055	RCL3	36 03					
056	RCL4	36 04					

REGISTER CONTENTS

7.026830000 0
 1109.577000 1
 233.1550000 2
 74.100000000 3
 0.720000000 4
 0.000000000 5
 0.000000000 6
 0.000000000 7
 0.000000000 8
 0.000000000 9

REGISTERS								
0	7,02683	1	1109.577	2	233.155	3	74.1	4 .72
S0	S1	S2	S3	S4	S5	S6	S7	S8 S9
A	B	C	D	E			I	

Program Description I

Program Title	67 - Anesthesia: Vapor pressure of Methoxyflurane
Contributor's Name	Richard C. Rodgers, M. D.
Address	2045 Oak Street, Apt. 3
City	San Francisco
	State CA
	Zip Code 94117

Program Description, Equations, Variables The vapor pressure of methoxyflurane can be described by an Antoine equation:

$$\log P \text{ (mm Hg)} = 7.08219 - \frac{1336.579}{T(\text{°C}) + 213.480}$$

Atmospheric pressure for the Gibbs-corrected calculation of P_V may be entered directly or estimated as :

$$P_A = 760.938 \cdot e^{-1.24 \times 10^{-4}} \text{ (alt in meter)}$$

The Gibbs-corrected P_V value is:

$$P_V \text{ (corrected)} = \exp \left\{ \frac{\text{mol. wt.}}{\text{spec; gravity} \cdot 1000} \frac{(P_A - 760)}{(0_K) \cdot 6.236 \times 10^4} + \ln (P_V) \right\}$$

Operating Limits and Warnings Antoine constants were fit to data from $6.27 \rightarrow 104.65^\circ\text{C}$, and calculated values deviate from the data by < .02%.

When preparing recorded magnetic card; constants for storage in registers are loaded on Side 1, program on Side 2.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

Sketch(es)**Sample Problem(s)**

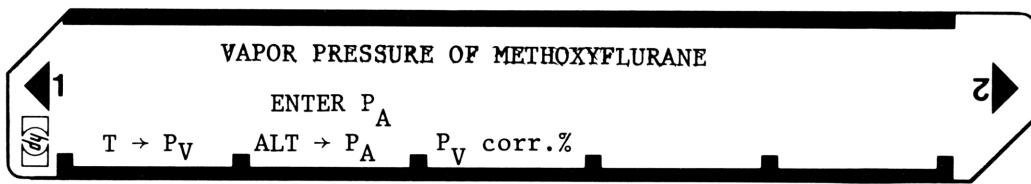
- 1) $T = 100^{\circ}\text{C}$, find P_V
- 2) $T=40^{\circ}\text{C}$, find P_V
- 3) Given altitude = 4500 ft., find P_A
- 4) Given altitude = 1000 m., find P_A
- 5) Calculate P_V corr at 35°C and 2500 feet altitude.

- Solution(s)**
- 1) $100[\text{A}] \rightarrow 658.43 \text{ mm Hg}, [\text{R/S}] \rightarrow 0.87 \text{ Atm.}, P_V$
 - 2) $40[\text{A}] \rightarrow 64.46 \text{ mm Hg}, [\text{R/S}] \rightarrow 0.08 \text{ Atm.}, P_V$
 - 3) $4500[\text{CHS}][\text{B}] \rightarrow 641.84 \text{ mm Hg}, P_A$
 - 4) $1000 [\text{B}] \rightarrow 672.13 \text{ mm Hg}, P_A$
 - 5) $35[\text{A}] 2500[\text{CHS}][\text{B}][\text{C}] \rightarrow 50.49 \text{ mm Hg}, P_V \text{ corr.}$
 $\text{R/S} \rightarrow 4.104123050-05 \% \text{ corr.}$

- Reference(s)**
- 1) Rodgers, R. C. & G. E. Hill, in preparation (1976).
 - 2) ICAO STD. Atm. Table SCIENTIFIC TABLES, Diem & Lentner, Ciba-Geigy, Basle (1972) Page 252.

User Instructions

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STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Side 1 of card to store constants for use with "copper kettle anesthesia regulation" program if desired.			
2	Use "copper kettle anesthesia regulation" program as desired. or			
1'	Load Sides 1 & 2.			
2'	Input temp. & calculate vapor pressure Optional: Convert Pv to Atm.	T, °C	A R/S	Pv, (mm Hg) Pv, (Atm.)
3'	Do either: A. Input altitude (meters +, or feet-) m, or Ft. B. Input atm. pressure from barometer Pa, mm Hg		B f B	Pa (mm Hg) Pa (mm Hg)
4	Calculate gibbs - corrected Pv		C	Pv (corr.)
5'	Calculate % correction		R/S	% corr.
	NOTE: When preparing recorded magnetic card from program register listings on following pages, perform the following steps:			
1	Load registers 0 through 4 with constants shown.			
2	With calculator in "run" mode, press "write data" key & pass Side 1 of blank card through card reader.			
3	Record program on Side 2 of card in usual manner.			
				SET STATUS
			FLAGS TRIG DISP	
			ON OFF DEG <input checked="" type="checkbox"/> GRAD <input type="checkbox"/> RAD <input type="checkbox"/>	FIX <input checked="" type="checkbox"/> SCI <input type="checkbox"/> ENG <input type="checkbox"/> n <u>2</u>
			0 <input type="checkbox"/> <input checked="" type="checkbox"/> 1 <input type="checkbox"/> <input checked="" type="checkbox"/> 2 <input type="checkbox"/> <input checked="" type="checkbox"/> 3 <input type="checkbox"/> <input checked="" type="checkbox"/>	

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	÷	-24	
002	ST07	35 07	T(°C) → (7)	058	EEX	-23	
003	RCL2	36 02		059	3	03	
004	+	-55		060	÷	-24	
005	RCL1	36 01		061	RCL5	36 05	
006	X>Y	-41		062	7	07	
007	÷	-24		063	6	06	
008	RCL0	36 00		064	0	00	
009	-	-45		065	-	-45	
010	CHS	-22		066	x	-35	
011	10^	16 33		067	RCL7	36 07	
012	ST06	35 06	P _V → (6)	068	2	02	
013	R/S	51	Display (mm Hg)	069	7	07	
014	7	07		070	3	03	
015	6	06		071	.	-62	
016	0	00		072	1	01	
017	÷	-24		073	5	05	
018	RTN	24	Display (atm.)	074	+	-55	
019	*LBLB	21 12		075	÷	-24	
020	X>0?	16-44		076	6	06	
021	GT01	22 01		077	.	-62	
022	CHS	-22		078	2	02	
023	.	-62		079	3	03	
024	3	03		080	6	06	
025	0	00		081	EEX	-23	
026	4	04		082	4	04	
027	8	08		083	÷	-24	
028	x	-35		084	RCL6	36 06	
029	*LBL1	21 01	Aly. in meters now	085	LN	32	
030	1	01		086	+	-55	
031	.	-62		087	e ^x	33	
032	2	02		088	R/S	51	Display P _V (corr.)
033	4	04		089	RCL6	36 06	
034	1	01		090	%CH	16 55	Disp. % Δ
035	CHS	-22		091	RTN	24	
036	EEX	-23		092	R/S	51	
037	4	04		REGISTER CONTENTS			
038	CHS	-22		7.082190000 0			
039	x	-35		1336.579000 1			
040	e ^x	33		213.48000000 2			
041	7	07		165.00000000 3			
042	6	06		1.4200000000 4			
043	0	00		0.0000000000 5			
044	.	-62		0.0000000000 6			
045	9	09		0.0000000000 7			
046	3	03		0.0000000000 8			
047	8	08		0.0000000000 9			
048	x	-35		[]			
049	ST05	35 05	P _A → (5)	[]			
050	RTN	24		[]			
051	*LBLb	21 16 12		[]			
052	ST05	35 05	P _A → (5)	[]			
053	RTN	24		[]			
054	*LBLc	21 13		[]			
055	RCL3	36 03		[]			
056	RCL4	36 04		[]			
REGISTERS							

0	7.08219	1336.579	2	213.480	3	165.0	4	1.42	5	P _A	6	P _V	7	T(°C)	8		9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9								
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	

Program Description I

Program Title ANESTHESIA: VAPOR PRESSURE OF ENFLURANE

Contributor's Name Richard C. Rodgers, M. D.

Address 2045 Oak Str., Apt. 3

City San Francisco

State CA

Zip Code 94117

Program Description, Equations, Variables

The vapor pressure of enflurane can be described by an Antoine equation:

$$\log P \text{ (mm Hg)} = 6.98840 - \frac{1107.839}{T(\text{°C})+213.063}$$

With < .3% deviation from experimental data over the range 17.3 → 56.4°C.

Atmospheric pressure is entered directly or estimated by an experimental fit to the ICAO Std. atmosphere Table (2):

$$P_A = 760.938 \cdot e^{-1.24 \times 10^{-4} \text{ (meters altitude)}}$$

Gibbs correction of P_V for P_A =

$$P_V \text{ (corrected)} = \exp \left\{ \frac{\frac{\text{mol. weight}}{\text{spec. grav} \cdot 1000} (P_A - 760)}{(0K) \cdot 6.236 \cdot 10^4} + \ln (P_V) \right\}$$

Operating Limits and Warnings No warranty of accuracy can be made for temps outside the above range.

When preparing recorded magnetic card; constants for storage in registers are loaded on Side 1, Program on Side 2.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

Sketch(es)

Sketch area for drawing diagrams or sketches related to the program description.

Sample Problem(s)

- 1) $T = 50^{\circ}\text{C}$, find P_V
- 2) $T = 20^{\circ}\text{C}$, find P_V
- 3) Given altitude = 4500 ft., find P_A
- 4) Given altitude = 1000 m, find P_A
- 5) Calculate $P_{V\text{corr.}}$ for 35°C & 2500 feet altitude.

Solution(s)

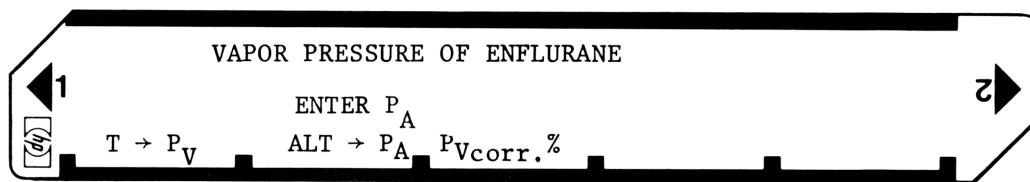
- 1) $50[\text{A}] \rightarrow 598.54 \text{ mmHg}$, $[\text{R/S}] \rightarrow 0.79 \text{ Atm.}$, P_V
- 2) $20[\text{A}] \rightarrow 171.80 \text{ mm Hg}$
 $[\text{R/S}] \rightarrow 0.23 \text{ Atm.}$, P_V
- 3) $4500[\text{CHS}][\text{B}] \rightarrow 641.84 \text{ mm Hg}$, P_A
- 4) $1000[\text{B}] \rightarrow 672.13 \text{ mm Hg}$, P_A
- 5) $35[\text{A}] 2500[\text{CHS}][\text{B}][\text{C}] \rightarrow 333.00 \text{ mm Hg}$, $P_{V\text{corr.}}$
 $[\text{R/S}] \rightarrow 4.285311567-05$, % corr.

Reference(s)

Reference area for listing sources or references used in the program development.

User Instructions

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STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Side 1 of card to store constants for use with "copper kettle anesthesia regulation" program if desired.			
2	Use "copper kettle anesthesia regulation" program as desired. or			
1'	Load Sides 1 & 2			
2'	Input temp. & calculate vapor pressure Optional: Convert P_V to Atm.	$T, {}^\circ C$	A R/S	$P_V, (\text{mm Hg})$ $P_V, (\text{Atm.})$
3'	Do either: A) Input altitude (meters +, or feet-) m, or Ft- B) Input atm. pressure from barometer $P_A, \text{ mm Hg}$		B f B	$P_A (\text{mm Hg})$ $P_A (\text{mm Hg})$
4'	Calculate Gibbs - corrected P_V		C	$P_V (\text{corr.})$
5'	Calculate % correction		R/S	% corr.
NOTE: When preparing recorded magnetic card from program register listings on following pages, perform the following steps:				
1	Load registers 0 through 4 with constants shown.			
2	With calculator in "run" mode press "write data" key and pass Side 1 of blank card through card reader.			
3	Record program on Side 2 of card in usual manner.			
SET STATUS				
FLAGS TRIG DISP				
ON OFF		DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>	
0 <input type="checkbox"/> <input checked="" type="checkbox"/>		GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>	
1 <input type="checkbox"/> <input checked="" type="checkbox"/>		RAD <input type="checkbox"/>	ENG <input type="checkbox"/>	
2 <input type="checkbox"/> <input checked="" type="checkbox"/>			n <u>2</u>	
3 <input type="checkbox"/> <input checked="" type="checkbox"/>				

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	÷	-24	
002	ST07	35 07	T(°C) → (7)	058	EEX	-23	
003	RCL2	36 02		059	3	03	
004	+	-55		060	÷	-24	
005	RCL1	36 01		061	RCL5	36 05	
006	X>Y	-41		062	7	07	
007	÷	-24		063	6	06	
008	RCL0	36 00		064	0	00	
009	-	-45		065	-	-45	
010	CHS	-22		066	x	-35	
011	10 ^x	16 33		067	RCL7	36 07	
012	ST06	35 06	P _V → (6)	068	2	02	
013	R/S	51		069	7	07	
014	7	07	Display (mm Hg)	070	3	03	
015	6	06		071	.	-62	
016	0	00		072	1	01	
017	÷	-24		073	5	05	
018	RTN	24		074	+	-55	
019	*LBLB	21 12	Display (atm.)	075	÷	-24	
020	X>0?	16-44		076	6	06	
021	GT01	22 01		077	.	-62	
022	CHS	-22		078	2	02	
023	.	-62		079	3	03	
024	3	03		080	6	06	
025	0	00		081	EEX	-23	
026	4	04		082	4	04	
027	8	08		083	• ÷	-24	
028	x	-35		084	RCL6	36 06	
029	*LBL1	21 01		085	LN	32	
030	1	01	Alt. in meters now.	086	+	-55	
031	.	-62		087	e ^x	33	
032	2	02		088	R/S	51	
033	4	04		089	RCL6	36 06	Display P _V (corr.)
034	1	01		090	%CH	16 55	
035	CHS	-22		091	RTN	24	
036	EEX	-23		092	R/S	51	Disp. % A
037	4	04					
038	CHS	-22					
039	x	-35					
040	e ^x	33					
041	7	07					
042	6	06					
043	0	00					
044	.	-62					
045	9	09					
046	3	03					
047	8	08					
048	x	-35					
049	ST05	35 05					
050	RTN	24					
051	*LBLb	21 16 12					
052	ST05	35 05					
053	RTN	24					
054	*LBLc	21 13					
055	RCL3	36 03					
056	RCL4	36 04					

REGISTERS

0 6,98840	1 1107.839	2 213.063	3 184.5	4 1.52	5 P _A	6 P _V	7 T(°C)	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	F	G	H	I	J

Program Description I

Program Title 67-Anesthesia: Vapor Pressure of Fluroxene

Contributor's Name Richard C. Rodgers, M.D.

Address 2045 Oak Street #3

City San Francisco

State CA

Zip Code 94117

Program Description, Equations, Variables

The vapor pressure of fluroxene can be described by an Antoine equation:

$$\log_{10} P(\text{mm Hg}) = 4.25274 - \frac{136.8463}{T(\text{°C}) + 56.1910}$$

Atmospheric pressure may be input directly or estimated on the basis of altitude as =

$$P_A (\text{mm Hg}) = 700.938 \cdot e^{-1.241 \times 10^{-4} (\text{alt. in meters})}$$

The Gibbs - corrected P_V value is:

$$P_V (\text{corrected}) = \exp \left\{ \frac{\text{sp. grav.} \cdot 1000}{(\text{°k}) \cdot 6.236 \times 10^4} \frac{(P_A - 760)}{+ \ln (P_V)} \right\}$$

Operating Limits and Warnings

Antoine constants were fit to data from 20 to 43.2 °C, and calculated values deviate from data by < 7.4%. This error is relatively large due to the paucity of data from which the constants are drawn.

When preparing recorded magnetic card; constants for storage in registers are loaded on side 1, program on side 2.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

Sketch(es)

<p>Sketch(es) area.</p>	<p>Sketch(es) area.</p>
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Sample Problem(s)

1. $T = 40^{\circ}\text{C}$, Find P_V
2. $T = 20^{\circ}\text{C}$, Find P_V
3. Given Altitude = 4500 feet, Find P_A
4. Given Altitude = 1000 Meters, Find P_A
5. Find P_V corr & % corr. for 35°C and 2500 Feet Altitude.

Solution(s)

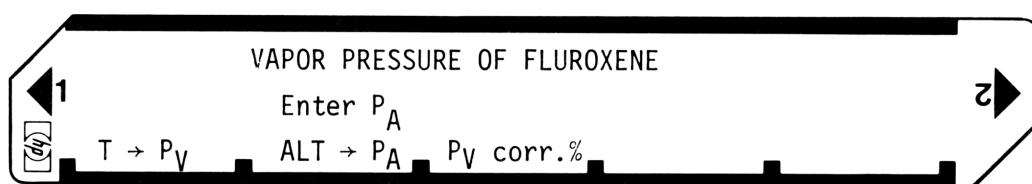
1. $40[A] \rightarrow 676.22 \text{ mm Hg, [R/S]} \rightarrow 0.89 \text{ Atm., } P_V$
2. $20[A] \rightarrow 286.18 \text{ mm Hg, [R/S]} \rightarrow 0.38 \text{ Atm., } P_V$
3. $4500 [\text{CHS}] [\text{B}] \rightarrow 641.84 \text{ mm Hg, } P_A$
4. $1000 [\text{B}] \rightarrow 672.13 \text{ mm Hg, } P_A$
5. $35[A] 2500[\text{CHS}] [\text{B}][\text{C}] \rightarrow 565.05 \text{ mm Hg, } P_V \text{ corr.}$
 $[R/S] \rightarrow 3.928881328 - 05, \% \text{ corr.}$

Reference(s)

1. Rodgers, A.C., & G.F. Hill, in Prep. (1976).
2. ICAO STD. ATM. Table, in Scientific Tables, Diem & Lentner, Ciba-Geigy, Basle (1972), p. 252.

User Instructions

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STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1.	Load side 1 of card to store constants for use with "Copper Kettle Anesthesia Regulation" program if desired.			
2.	Use "Copper Kettle Anesthesia" regulation program as desired OR			
1'	Load sides 1 & 2			
2'	Input temp & calculate vapor pressure Optional: convert P_V to Atm.	$T, {}^\circ C$	A R/S	$P_V, (\text{mm Hg})$ $P_V, (\text{Atm.})$
3'	Do either: a) Input altitude (meters +, or feet -) b) Input Atm. pressure from barometer	m, or ft- $P_A, \text{ mm Hg}$	B f B	$P_A (\text{mm Hg})$ $P_A (\text{mm Hg})$
4'	Calculate Gibbs - Corrected P_V		C	$P_V (\text{corr.})$
5'	Calculate % correction		R/S	% corr.
NOTE: When preparing recorded magnetic card from program register listings on following pages perform the following steps:				
1. Load registers 0 thru 4 with constants shown.				
2. With calculator in "Run" mode press "Write Data" key & pass side 1 of blank card thru card reader.				
3. Record program on side 2 of card in usual manner.				
SET STATUS				
FLAGS TRIG DISP				
ON OFF DEG <input checked="" type="checkbox"/> GRAD <input type="checkbox"/> FIX <input checked="" type="checkbox"/> 0 <input type="checkbox"/> <input checked="" type="checkbox"/> DEG <input checked="" type="checkbox"/> SCI <input type="checkbox"/> 1 <input type="checkbox"/> <input checked="" type="checkbox"/> GRAD <input type="checkbox"/> ENG <input type="checkbox"/> 2 <input type="checkbox"/> <input checked="" type="checkbox"/> RAD <input type="checkbox"/> 3 <input type="checkbox"/> <input checked="" type="checkbox"/> n <u>2</u>				

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	÷	-24	
002	ST07	35 07		058	EEX	-23	
003	RCL2	36 02		059	3	03	
004	+	-55		060	÷	-24	
005	RCL1	36 01		061	RCL5	36 05	
006	X ² Y	-41		062	7	07	
007	÷	-24		063	6	06	
008	RCL0	36 00		064	0	00	
009	-	-45		065	-	-45	
010	CHS	-22		066	x	-35	
011	10 ^X	16 33	T (°C) → (7)	067	RCL7	36 07	
012	ST06	35 06	P _V → 16)	068	2	02	
013	R/S	51	Display mm Hg	069	7	07	
014	7	07		070	3	03	
015	6	06		071	.	-62	
016	0	00		072	1	01	
017	÷	-24	Display Atm.	073	5	05	
018	RTN	24		074	+	-55	
019	*LBLB	21 12		075	÷	-24	
020	X>0?	16-44		076	6	06	
021	GT01	22 01		077	.	-62	
022	CHS	-22		078	2	02	
023	.	-62		079	3	03	
024	3	03		080	6	06	
025	0	00		081	EEX	-23	
026	4	04		082	4	04	
027	8	08		083	÷	-24	
028	x	-35	Alt. in meters now	084	RCL6	36 06	
029	*LBL1	21 01		085	LN	32	
030	1	01		086	+	-55	
031	.	-62		087	e ^X	33	Display P _V (corr.)
032	2	02		088	R/S	51	
033	4	04		089	RCL6	36 06	
034	1	01		090	%CH	16 55	Display % corr.
035	CHS	-22		091	RTN	24	
036	EEX	-23		092	R/S	51	
037	4	04					
038	CHS	-22					
039	x	-35					
040	e ^X	33					
041	7	07					
042	6	06					
043	0	00					
044	.	-62					
045	9	09					
046	3	03					
047	8	08					
048	x	-35	P _A → (5)				
049	ST05	35 05					
050	RTN	24					
051	*LBLb	21 16 12					
052	ST05	35 05					
053	RTN	24					
054	*LBLC	21 13					
055	RCL3	36 03					
056	RCL4	36 04					

REGISTERS

0 4.25274	1 136.8463	2 56.1910	3 126.0	4 1.13	5 P _A	6 P _V	7 T (°C)	8 	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	F	G	H	I	J

Program Description I

Program Title 67 - ANESTHESIA: VAPOR PRESSURE OF CYCLOPROPANE

Contributor's Name Richard C. Rodgers, M. D.

Address 2045 Oak Street, Apt. 3

City San Francisco

State CA

Zip Code 94117

Program Description, Equations, Variables The vapor pressure of cyclopropane can be described by an Antoine equation =

$$\log_{10} P_V \text{ (mm Hg)} = 6.64481 - \frac{723.3158}{T(\text{°C}) + 225.699}$$

Other programs in this series calculate a correction for P_V based on atmospheric pressure. However, since the boiling point of cyclopropane is so low (-33°C), this is not done in this program.

Operating Limits and Warnings Antoine constants were fit to data from -116.8 to -33.5°C, and calculated values deviate from data by < 1%.

When preparing recorded magnetic card; constants for storage in registers are loaded on Side 1, program on Side 2.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

Sketch(es)



Sample Problem(s)

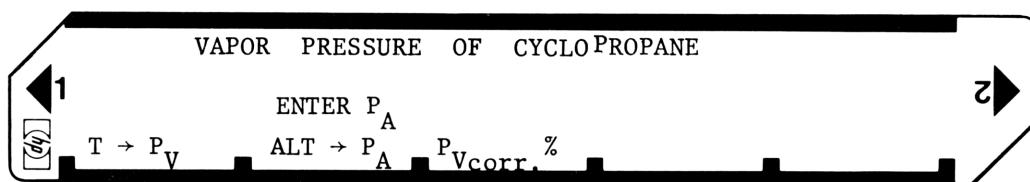
- 1) $T = -33^\circ\text{C}$, find P_V
- 2) $T = -60^\circ\text{C}$, find P_V
- 3) Given altitude = 4500 feet, find P_A
- 4) Given altitude = 1000 meter, find P_A

- Solution(s)**
- 1) $33[\text{CHS}][\text{A}] \rightarrow 778.41 \text{ mm Hg, [R/S]} \rightarrow 1.02 \text{ Atm.}, P_V$
 - 2) $60[\text{CHS}][\text{A}] \rightarrow 190.36 \text{ mm Hg, [R/S]} \rightarrow 0.25 \text{ Atm.}, P_V$
 - 3) $4500[\text{CHS}][\text{B}] \rightarrow 641.84 \text{ mm Hg, } P_A$
 - 4) $1000 [\text{B}] \rightarrow 672.13 \text{ mm Hg, } P_A$

- Reference(s)**
- 1) Rodgers, R. C. & G. E. Hill, in prep. (1976).
 - 2) ICAO Std. Atm. Table, in SCIENTIFIC TABLES, Diem & Lentner, CIBA-Geigy, Basle (1972), Page 252.

User Instructions

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STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load Side 1 of card to store constants for use with "copper kettle anesthesia regulation" program if desired.			
2	Use "copper kettle anesthesia regulation" program as desired. OR			
1'	Load Sides 1 and 2.			
2'	Input temp. & calculate vapor pressure Optional: Convert P_V to Atm.	$T, {}^\circ C$	A R/S	$P_V, (\text{mmHg})$ $P_V, (\text{Atm.})$
3'	Do either: A) Input altitude (meters +, or feet -) B) Input atm. pressure from barometer	$m, \text{ or Ft-}$ $P_A, \text{ mm Hg}$	B f B	$P_A (\text{mm Hg})$ $P_A (\text{mm Hg})$
	NOTE: When preparing recorded magnetic card from program and register listings on following pages, perform the following steps:			
1	Load Registers 0 through 4 with constants shown.			
2	With calculator in "run" mode, press "write data" key and pass Side 1 of blank card through card reader.			
3	Record program on Side 2 of card in usual manner.			
			SET STATUS	
			FLAGS	TRIG
			ON OFF	DEG <input checked="" type="checkbox"/>
			0 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>
			1 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>
			2 <input type="checkbox"/> <input checked="" type="checkbox"/>	SCI <input type="checkbox"/>
			3 <input type="checkbox"/> <input checked="" type="checkbox"/>	ENG <input type="checkbox"/>
				n <u>2</u>

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS		
001	*LBLA	21 11							
002	ST07	35 07							
003	RCL2	36 02							
004	+	-55							
005	RCL1	36 01							
006	X ² Y	-41							
007	÷	-24							
008	RCL0	36 00							
009	-	-45							
010	CHS	-22							
011	10 ^x	16 33							
012	ST06	35 06							
013	R/S	51							
014	7	07							
015	6	06							
016	0	00							
017	÷	-24							
018	RTN	24							
019	*LBLB	21 12							
020	X>0?	16-44							
021	GT01	22 01							
022	CHS	-22							
023	.	-62							
024	3	03							
025	0	00							
026	4	04							
027	8	08							
028	x	-35							
029	*LBL1	21 01							
030	1	01							
031	.	-62							
032	2	02							
033	4	04							
034	1	01							
035	CHS	-22							
036	EEX	-23							
037	4	04							
038	CHS	-22							
039	x	-35							
040	e ^x	33							
041	7	07							
042	6	06							
043	0	00							
044	.	-62							
045	9	09							
046	3	03							
047	8	08							
048	x	-35							
049	ST05	35 05							
050	RTN	24							
051	R/S	51							
			P _A → (5)						
			T(°C) → (7)						
			Display atm.						
			Alt. in meters now						
			Display mm Hg						
			REGISTER CONTENTS						
			060						
			6.644810000 0						
			723.3158000 1						
			225.6990000 2						
			42.080000000 3						
			1.450000000 4						
			0.000000000 5						
			0.000000000 6						
			0.000000000 7						
			0.000000000 8						
			0.000000000 9						
			080						
			100						
			110						
			REGISTERS						
06.64481	1 723.3158	2 225.699	3 42.08	4 1.45	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				

Program Description I

Program Title Anesthesia: Vapor Pressure of Trichloroethylene

Contributor's Name Richard C. Rodgers, M.D.

Address 2045 Oak Street #3

City San Francisco

State California

Zip Code 94117

Program Description, Equations, Variables

The vapor pressure of trichloroethylene can be described by an Antoine Equation:

$$\log P \text{ (mm Hg)} = 6.83694 - \frac{1198.477}{T(\text{°C}) + 276.436}$$

with <.7% deviation from experimental data over the range -20 to 100 °C.

Atmospheric pressure is entered directly or estimated by an exponential fit to the ICAO STD. Atmospheric tables(2):

$$P_A = 760.938 \cdot e^{-1.241 \times 10^{-4}} \text{ (alt. in meters)}$$

Gibbs - corrected P_V is:

$$P_V(\text{corrected}) = \exp \left\{ \frac{\frac{\text{mol. weight}}{\text{spec. grow} \cdot 1000} (P_A - 760)}{(\text{°K}) \cdot 6.236 \times 10^4} + \ln (P_V) \right\}$$

Operating Limits and Warnings

When preparing recorded magnetic card; constants for storage in registers are loaded on side 1, program on side 2.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

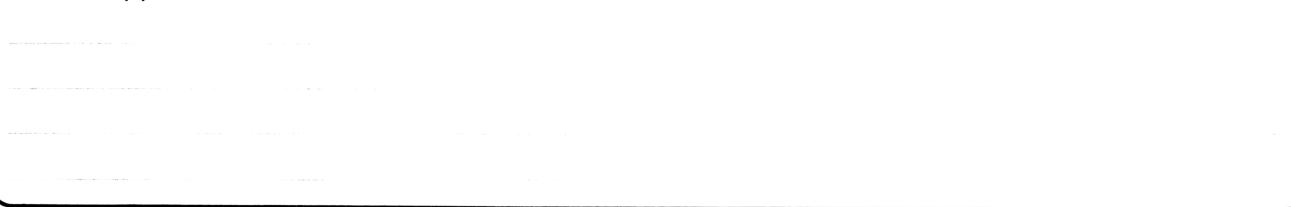
Sketch(es)

Sample Problem(s)

1. $T = 80^\circ\text{C}$, find P_V
2. $T = 40^\circ\text{C}$, find P_V
3. Given Altitude = 4500 ft., find P_A
4. Given Altitude = 1000 m, find P_A
5. Calculate P_V corr. & % corr. for 35°C & 2500 feet Altitude.

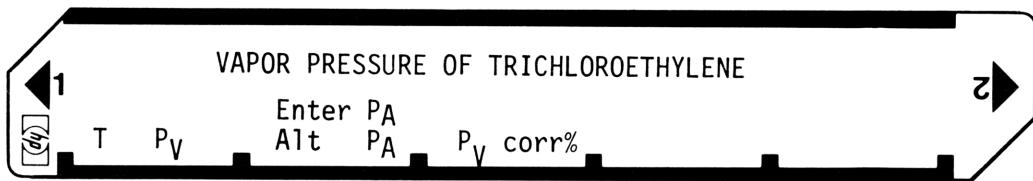
Solution(s)

1. $80[A] \longrightarrow 622.28 \text{ mm Hg, [R/S]} \longrightarrow 0.82 \text{ Atm.}, P_V$
2. $40[A] \longrightarrow 145.66 \text{ mm Hg, [R/S]} \longrightarrow 0.19 \text{ Atm.}, P_V$
3. $4500[\text{CHS}] [B] \rightarrow 641.84 \text{ mm Hg, } P_A$
4. $1000[B] \longrightarrow 672.13 \text{ mm Hg, } P_A$
5. $35[A] 2500[\text{CHS}] [B] [C] \longrightarrow 117.60 \text{ mm Hg, } P_V \text{ corr.}$
 $[R/S] \longrightarrow 3.171743266-05, \% \text{ corr.}$

Reference(s)


User Instructions

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STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1.	Load side 1 of card to store constants for use with "Copper Kettle Anesthesia Regulation" program if desired			
2.	Use "Copper Kettle Anesthesia" regulation program as desired OR			
1'	Load sides 1 and 2			
2'	Input temp & calculate vapor pressure Optional: Convert Pv to Atm.	T, °C	A R/S	Pv, (mm Hg) Pv, (Atm.)
3'	Do either: a) Input altitude (meters +, or feet-) m, or ft- b) Input Atm. pressure from Barometer PA, mm Hg		B f PA, mm Hg	PA, (mm Hg) PA, (mm Hg)
4'	Calculate Gibbs - correct Pv		C	Pv (corr.)
5'	Calculate % correction		R/S	% corr.
NOTE: When preparing recorded magnetic card from program register listings on following pages perform the following steps:				
1.	Load registers 0 thru 4 with constants shown.			
2.	With calculator in "Run" mode press "Write Data" key & pass side 1 or blank card thru card reader.			
3.	Record program on side 2 of card in usual manner.			
SET STATUS				
FLAGS TRIG DISP				
ON OFF DEG <input checked="" type="checkbox"/> FIX <input checked="" type="checkbox"/> 0 <input type="checkbox"/> <input checked="" type="checkbox"/> GRAD <input type="checkbox"/> SCI <input type="checkbox"/> 1 <input type="checkbox"/> <input checked="" type="checkbox"/> RAD <input type="checkbox"/> ENG <input type="checkbox"/> 2 <input type="checkbox"/> <input checked="" type="checkbox"/> 3 <input type="checkbox"/> <input checked="" type="checkbox"/>				

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	÷	-24	
002	ST07	35 07	T(°C) → (7)	058	EEX	-23	
003	RCL2	36 02		059	3	03	
004	+	-55		060	÷	-24	
005	RCL1	36 01		061	RCL5	36 05	
006	X#Y	-41		062	7	07	
007	÷	-24		063	6	06	
008	RCL0	36 00		064	0	00	
009	-	-45		065	-	-45	
010	CHS	-22		066	x	-35	
011	10 ^x	16 33	P _V → (6)	067	RCL7	36 07	
012	ST06	35 06		068	2	02	
013	R/S	51	Display (mm Hg)	069	7	07	
014	7	07		070	3	03	
015	6	06		071	.	-62	
016	0	00		072	1	01	
017	÷	-24		073	5	05	
018	RTN	24	Display (Atm)	074	+	-55	
019	*LBLB	21 12		075	÷	-24	
020	X>0?	16-44		076	6	06	
021	GT01	22 01		077	.	-62	
022	CHS	-22		078	2	02	
023	.	-62		079	3	03	
024	3	03		080	6	06	
025	0	00		081	EEX	-23	
026	4	04		082	4	04	
027	8	08		083	÷	-24	
028	x	-35	Alt. in meters now	084	RCL6	36 06	
029	*LBL1	21 01		085	LN	32	
030	1	01		086	+	-55	
031	.	-62		087	e ^x	33	Display P _V (corr.)
032	2	02		088	R/S	51	
033	4	04		089	RCL6	36 06	
034	1	01		090	%CH	16 55	Display % Δ
035	CHS	-22		091	RTN	24	
036	EEX	-23		092	R/S	51	
037	4	04					
038	CHS	-22					
039	x	-35					
040	e ^x	33					
041	7	07					
042	6	06					
043	0	00					
044	.	-62					
045	9	09					
046	3	03					
047	8	08					
048	x	-35	P _A → (5)				
049	ST05	35 05					
050	RTN	24					
051	*LBLb	21 16 12					
052	ST05	35 05	P _A → (5)				
053	RTN	24					
054	*LBLC	21 13					
055	RCL3	36 03					
056	RCL4	36 04					

REGISTERS

0 6.83694	1 1198.477	2 216.436	3 131.4	4 1.46	5 P _A	6 P _V	7 T(°C)	8 	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C		D	E		I		

Program Description I

Program Title 67 - ANESTHESIA: VAPOR PRESSURE OF ETHYL CHLORIDE

Contributor's Name Richard C. Rodgers, M. D.

Address 2045 Oar St., Apt. 3

City San Francisco

State CA

Zip Code 94117

Program Description, Equations, Variables The vapor pressure of ethyl chloride can be described by an antoine equation:

$$\log_{10} P(\text{mm Hg}) = 7.39046 - \frac{1296.620}{T(\text{°C}) + 269.157}$$

Atmospheric pressure may be input directly or estimated on the basis of altitude as:

$$P_A(\text{mm Hg}) = 760.938 \cdot e^{-1.24 \times 10^{-4} (\text{alt. in meter})}$$

The Gibbs-corrected P_V value is:

$$P_V(\text{corrected}) = \exp \left\{ \frac{\frac{\text{mol wt.}}{\text{sp. grav} \cdot 1000} \cdot \frac{(P_A - 760)}{(0_K) \cdot 6.236 \times 10^4} + \ln(P_V)}{} \right\}$$

Operating Limits and Warnings Antoine constants were fit to data from 12.3 to 187.2°C, and calculated values deviate from data by < 3.0%. This is an unusually large error for an Antoine fit and is due to the mediocre quality of the experimental data used.

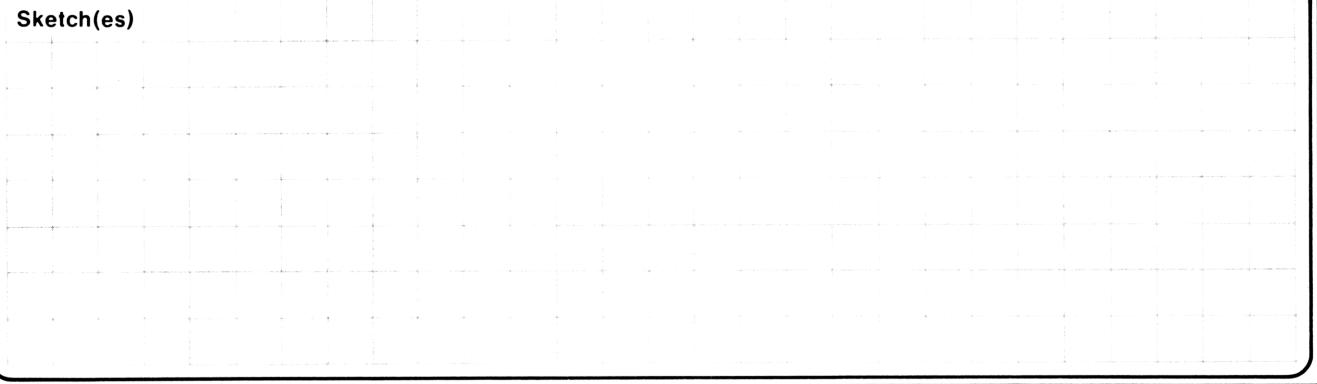
When preparing recorded magnetic card; constants for storage in registers are loaded on Side 1, program on Side 2.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

Sketch(es)



Sample Problem(s)

- 1) $T = 15^\circ\text{C}$, find P_V
- 2) $T = -10^\circ\text{C}$, find P_V
- 3) Given altitude = 4500 ft., find P_A
- 4) Given altitude = 1000 M., find P_A
- 5) Calculate P_V corr for 10°C and 2500 feet altitude.

Solution(s)

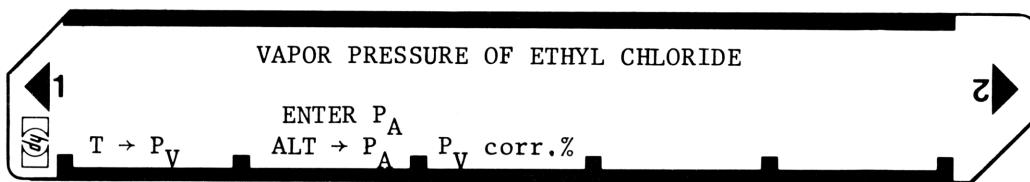
- 1) $15[\text{A}] \rightarrow 836.44 \text{ mm/Hg}$, [R/S] $\rightarrow 1.10 \text{ Atm.}$, P_V
- 2) $10[\text{CHS}][\text{A}] \rightarrow 310.04 \text{ mm Hg}$ [R/S] $\rightarrow 0.41 \text{ Atm.}$, P_V
- 3) $4500[\text{CHS}][\text{B}] \rightarrow 641.84 \text{ mm Hg}$, P_A
- 4) $1000[\text{B}] \rightarrow 672.13 \text{ mm Hg}$, P_A
- 5) $10[\text{A}] 2500[\text{CHS}][\text{B}][\text{C}] \rightarrow 695.68 \text{ mm Hg}$, P_V corr. [R/S] $\rightarrow 2.695202564-05$, % corr.

Reference(s)

- 1) Rodgers, R. C. and G. E. Hill, in prep. (1976)
- 2) ICAO Std. Atm. Table, in SCIENTIFIC TABLES, Diem & Lentner, Ciba - Geigy, Basle (1972), Page 252

User Instructions

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STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load Side 1 of card to store constants for use with "copper kettle anesthesia regulation" program if desired.			
2	Use "copper kettle anesthesia regulation" program as desired. or			
1'	Load Sides 1 & 2			
2'	Input temp. & calculate vapor pressure Optional: Convert Pv to Atm.	T, °C	A R/S	Pv, (mm Hg) Pv, (Atm.)
3'	Do either: A. Input altitude (meters +, or feet-) B. Input atm. pressure from barometer	m, or Ft- PA, mm Hg	B f C R/S	PA (mm Hg) PA (mm Hg) Pv (corr.) % corr.
4'	Calculate Gibbs - corrected Pv			
5'	Calculate % correction			
	NOTE: When preparing recorded magnetic card from program and register listings on following pages, perform the following steps:			
1	Load Registers 0 through 4 with constants shown.			
2	With calculator in "run" mode press "write data" key and pass Side 1 of blank card through card reader.			
3	Record program on Side 2 of card in usual manner.			
				SET STATUS
			FLAGS TRIG DISP	
		ON OFF	DEG <input checked="" type="checkbox"/> GRAD <input type="checkbox"/> RAD <input type="checkbox"/>	FIX <input checked="" type="checkbox"/> SCI <input type="checkbox"/> ENG <input type="checkbox"/> n 2
		0 <input type="checkbox"/> <input checked="" type="checkbox"/> 1 <input type="checkbox"/> <input checked="" type="checkbox"/> 2 <input type="checkbox"/> <input checked="" type="checkbox"/> 3 <input type="checkbox"/> <input checked="" type="checkbox"/>		

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	=	-24	
002	ST07	35 07		058	EEX	-23	
003	RCL2	36 02		059	3	03	
004	+	-55	T(°C) → (7)	060	=	-24	
005	RCL1	36 01		061	RCL5	36 05	
006	X ² Y	-41		062	7	07	
007	÷	-24		063	6	06	
008	RCL0	36 00		064	0	00	
009	-	-45		065	-	-45	
010	CHS	-22		066	x	-35	
011	10 ^X	16 33		067	RCL7	36 07	
012	ST06	35 06	P _V → (6)	068	2	02	
013	R/S	51		069	7	07	
014	7	07	Display mm Hg	070	3	03	
015	6	06		071	.	-62	
016	0	00		072	1	01	
017	÷	-24		073	5	05	
018	RTN	24	Display Atm.	074	+	-55	
019	*LBLB	21 12		075	=	-24	
020	X>0?	16-44		076	6	06	
021	GT01	22 01		077	.	-62	
022	CHS	-22		078	2	02	
023	.	-62		079	3	03	
024	3	03		080	6	06	
025	0	00		081	EEX	-23	
026	4	04		082	4	04	
027	8	08		083	÷	-24	
028	x	-35		084	RCL6	36 06	
029	*LBL1	21 01	Alt. in meters now	085	LN	32	
030	1	01		086	+	-55	
031	.	-62		087	e ^X	33	Display P _V (corr.)
032	2	02		088	R/S	51	
033	4	04		089	RCL6	36 06	
034	1	01		090	%CH	16 55	
035	CHS	-22		091	RTN	24	Display % corr.
036	EEX	-23		092	R/S	51	
037	4	04					
038	CHS	-22					
039	x	-35	REGISTER CONTENTS				
040	e ^X	33					
041	7	07					
042	6	06			7.390460000	0	
043	0	00			1269.620000	1	
044	.	-62			269.1570000	2	
045	9	09			64.520000000	3	
046	3	03			0.921000000	4	
047	8	08			0.000000000	5	
048	x	-35			0.000000000	6	
049	ST05	35 05			0.000000000	7	
050	RTN	24	P _A → (5)		0.000000000	8	
051	*LBLb	21 16 12			0.000000000	9	
052	ST05	35 05					
053	RTN	24					
054	*LBLC	21 13					
055	RCL3	36 03					
056	RCL4	36 04					

REGISTERS

⁰ 7.39046	¹ 1269.620	² 269.157	³ 64.52	⁴ .921	⁵ P _A	⁶ P _V	⁷ T(°C)	⁸	⁹
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	F	G	H	I	J

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ANESTHESIA

Programs are provided to calculate patient data including acceptable blood loss and fluid requirements; delivered concentration and vaporizer output, respiratory setup and deadspace adjustments, and anesthesia machine regulation and settings. Other programs provide calculations of vapor pressure versus temperature for 9 different compounds of interest to anesthesiologists and a program for obtaining Antoine constants from tables of vapor pressure versus temperature.

ANESTHESIA PARAMETERS I

ANESTHESIA PARAMETERS II

PULMONARY MEDICINE: RESPIRATORY SET UP AND
DEADSPACE ADJUSTMENTS

COPPER KETTLE ANESTHETIC REGULATION

ANESTHESIA: ANTOINE VALUES FROM EXPERIMENTAL DATA

VAPOR PRESSURE PROGRAM COMMENTS

ANESTHESIA: VAPOR PRESSURE OF WATER

ANESTHESIA: VAPOR PRESSURE OF HALOTHANE

ANESTHESIA: VAPOR PRESSURE OF DIETHYL ETHER

ANESTHESIA: VAPOR PRESSURE OF METHOXYFLURANE

ANESTHESIA: VAPOR PRESSURE OF ENFLURANE

ANESTHESIA: VAPOR PRESSURE OF FLUROXENE

ANESTHESIA: VAPOR PRESSURE OF CYCLOPROPANE

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