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BS Computer Science
BS Chemistry
Tennessee State University

Handbook of Chemistry and Physics
French Système International d'Unités

Sample calculations for applications in science and information technology

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PPM = Parts Per Million   PPB = Parts Per Billion   1 PPM = 1000 PPB

1 ppm = 1 mg/L   2.2 lbs = 1 Kg   1 000 000 ug = 1 gram
1000 mg = 1 gram   1 ppb = 1 µg /L   3.79 Liter = US Gallon

1000 gram = 1 Kg   1000 ml = 1 Liter   1000 ug = 1 mg
5280 feet = 1 mile   1 cm = 2.54 inch   mile = 1.15 Nautical mile

pH = pKa + Log [Base/ Acid] , pH + pOH = 14

Molarity = Moles / L , Liter = 0.265 US Gals
Mole = Atoms in 12 grams of Carbon - 12
= 6.02214076 × 10 E23 atoms
= Physicist Amedeo Avogadro (1811)

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Analysis for Hydrogen (L) @ STP - (H_2)

Analysis Results

Analyzer #	Test/Units	Specs	Analysis Results	Limit of Detection
Organoleptic	Odor	None	None	
Note 1	PPM O_2	<= 2.00	1.26	0.10
Note 1	PPM CO	<= 1.00	0.21	0.10
Lab	PPM CO_2	<= 1.00	0.10	0.10
Batch	PPM H_2O	<= 1.00	0.10	0.00
Lab	PPM THC	<= 1.00	0.10	0.10
Lab	PPM Nitrogen	<= 1.00	0.20	0.20
Assay Results (by difference)	Hydrogen Min %	≥ 99.0%	99.99980	

PPM O_2 Method Used :
PPM CO Method Used : Note 1

Manufacturer/Model# :
Manufacturer/Model# : Note 1

Note 1 :

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Free with the purchase of scientific or engineering consultations.

CALCULATION
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Specific Heat Thermodynamics

A Denmark Aerospace Company with headquarters in Copenhagen manufacturers aircraft parts for commercial and military aircrafts. Also, the aerospace company aims to provide aircraft manufacturers in Corsica, Reunion Island, New Caledonia, Guadeloupe, Picardie, and Lorraine with innovative heat transfer solutions for both commercial and military aircrafts.

Recently, the engine manufacturers were obligated by several certification firms to determine if saltwater in the intake air of the aircraft engines is or is not statistically insignificant to the remaining service life of the engines for both commercial and military aircrafts.

To resolve the saltwater certification issues, the aerospace company opens a research laboratory on St. Thomas in the United States Virgin Islands near Petersborg. Petersborg is located less than a mile from Magen's Bay Beach on the Northside of St. Thomas in the United States Virgin Islands. Since Magen's Bay Beach is part of the Atlantic Ocean, which is mainly saltwater, the new research laboratory is in one of the best locations to resolve the certification issues.

The aerospace company also purchased a copy of Software JBertrand Calculer. After the software was purchased, the aerospace company hired a chemist, computer scientist, and several engineers for consultant work in the United States Virgin Islands using Software JBertrand Calculer Consultant Services.

The team held the Petersborg kick-off meeting with the sample solution below near Magen's Bay.

Solution

If 200 Grams of saltwater in the Atlantic Ocean at 79 C is mixed with 100 Grams of commercial aircraft engine coolant liquid at 197 C, what is the final temperature of the mix?

Derive the PH + POH formula then use it to find the POH of the mix if the PH is 8.1.

SOLUTION

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SPECIFIC HEAT
OF SEA H2O = 3.93 $\frac{J}{g \cdot C}$

SPECIFIC HEAT
OF COOLANT = 2.36 $\frac{J}{g \cdot C}$

COOLANT
BOIL PT = 197 C

SEA H2O
AT STP = 79 C

HEAT GAIN = HEAT LOSS

$(t - 79) = (197 - t)$

(200 grams)(3.93 J/g . C)(t − 79) = (100 grams)(2.36 J/g . C)(197 − t)

$(2)(3.93)(t - 79) = (1)(2.36)(197 - t)$

$7.86t - 621 = 465 - 2.36t$

$10.22t = 1086$

$t = 106.26$

FINAL TEMP = 106C

FINAL TEMP = 106C

SOLUTION

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$$PH = -Log [H+]$$

$$POH = -Log [OH^-]$$

$$\text{Ion product} = 1.0*10^{-14}$$

$$[H+][OH^-] = 1.0*10^{-14}$$

$$Log [H+][OH^-] = Log [1.0*10^{-14}]$$

$$Log[H+] + Log[OH^-] = Log [1.0*10^{-14}]$$

$$\frac{Log[H+] + Log[OH^-] = Log [1.0*10^{-14}]}{-1}$$

$$PH + POH = 14$$

$$\boxed{PH + POH = 14}$$

SOLUTION CON'T

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$pH + pOH = 14$

$pH = 8.1$

$pOH = 14 - pH$

$pOH = 14 - 8.1$

$pOH = 5.9$

$\boxed{pOH = 5.9}$

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Product	Specific Heat - c_p -	
	(kJ/(kg K))	(Btu/(lb °F)) (Kcal/kg °C)
Acetic acid	2.043	0.49
Acetone	2.15	0.51
Alcohol, ethyl 32°F (ethanol)	2.3	0.548
Alcohol, ethyl 104°F (ethanol)	2.72	0.65
Alcohol, methyl. 40 - 50°F	2.47	0.59
Alcohol, methyl. 60 - 70°F	2.51	0.6
Alcohol, propyl	2.37	0.57
Ammonia, 32°F	4.6	1.1
Ammonia, 104°F	4.86	1.16
Ammonia, 176°F	5.4	1.29
Ammonia, 212°F	6.2	1.48
Ammonia, 238°F	6.74	1.61
Aniline	2.18	0.514
Asphalt, liquid	2.09	0.5
Benzene, 60°F	1.8	0.43
Benzene, 150°F	1.92	0.46
Benzine	2.1	
Benzol	1.8	0.43
Bismuth, 800°F	0.15	0.0345
Bismuth, 1000°F	0.155	0.0369
Bismuth, 1400°F	0.165	0.0393
Bromine	0.47	0.11
n-Butane, 32°F	2.3	0.55
Calcium Chloride	3.06	0.73
[illegible]	[illegible]	[illegible]

Product	Specific Heat - c_p - (kJ/(kg K))	Specific Heat - c_p - (Btu/(lb °F)) (Kcal/kg °C)
Decane	2.21	0.528
Diphenylamine	1.93	0.46
Dodecane	2.21	0.528
Dowtherm	1.55	0.37
Ether	2.21	0.528
Ethyl ether	2.22	0.529
Ethylene glycol	2.36	0.56
Dichlorodifluoromethane R-12 saturated -40°F	0.88	0.211
Dichlorodifluoromethane R-12 saturated 0°F	0.91	0.217
Dichlorodifluoromethane R-12 saturated 120°F	1.02	0.244
Fuel Oil min.	1.67	0.4
Fuel Oil max.	2.09	0.5
Gasoline	2.22	0.53
Glycerine	2.43	0.576
Heptane	2.24	0.535
Hexane	2.26	0.54
Hydrochlor acid	3.14	
Iodine	2.15	0.51
Kerosene	2.01	0.48
Linseed Oil	1.84	0.44
Light Oil, 60°F	1.8	0.43
Light Oil, 300°F	2.3	0.54
Mercury	0.14	0.03
Methyl alcohol	2.51	
Milk	3.93	0.94
Naphthalene	1.72	0.41
Nitric acid	1.72	
Nitro benzole	1.52	0.362
Octane	2.15	0.51
Oil, Castor	1.97	0.47
Oil, Olive	1.97	0.47
Oil, mineral	1.67	0.4
Oil, turpentine	1.8	
Oil, vegetable	1.67	0.4
Olive oil	1.97	0.47
Paraffin	2.13	0.51
Perchlor ethylene	0.905	
Petroleum	2.13	0.51
Petroleum ether	1.76	
Phenol	1.43	0.34
Potassium hydrate	3.68	0.88
Propane, 32°F	2.4	0.576
Propylene	2.85	0.68
Propylene Glycol	2.5	0.60
Sesame oil	1.63	0.39
Sodium, 200°F	1.38	0.33
Sodium, 1000°F	1.26	0.3
Sodium hydrate	3.93	0.94
Soya bean oil	1.97	0.47
Sulfuric acid concentrated	1.38	
Sulfuric acid	1.34	
Toluene	1.72	0.41
Trichlor ethylene	1.30	
Tuluol	1.51	0.36
Turpentine	1.72	0.411
Water, fresh	4.19	1
Water, sea 36°F	3.93	0.938
Xylene	1.72	0.41

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