Index

abbreviated injury score 74
abdominal aortic cross-clamp 220
abdominal aortic surgery 245
acclimatization 117, 119
acetazolamide
  high-altitude complications 120
  approach to 298–99
acetylene tracer 209
acid–base balance 250, 295–310
  normal 295
  acid–base disorders
    compensation equations 299
    diagnosis 297
    mixed 300
    simple 299
acids 295
acinar airway reduction factor 349
acute lung injury 170, 177
acute mountain sickness 120
acute respiratory distress syndrome
  153, 160, 318
  alveolar deadspace 177
  mechanical ventilation 169
  ventilation/perfusion mismatch 322
adults
  normal respiratory values 5
  air
    constituents of 116
  air embolism 4, 204, 444
  air travel 116
  airway
    anesthesia 48
    difficult 34
    establishment of 48
    integrity 56
    neonates 91
  airway devices
    out-of-hospital setting 20
  airway maintenance 34
  airway management
    hospital setting 32–35
    operating room 37–41
    out-of-hospital setting 19–29
  airway obstruction
    conscious sedation 108–09
    monitoring 13
  alveolar–arterial gradient 56
  arterial–alveolar gradient 235
  arterial–alveolar PCO₂ gap 235
avenue—alveolar interface 340
  alanine 239
  alarm systems 378
  alcoholic ketoacidosis 302
  aloniasi 410
  altitude exposure 115
  alveolar pressure changes 117
  and pressure 116
  capnometry 124
  human physiology 116
  hypopcapnia 256
  lung volume 119
  altitude mountain sickness 117
  alveolar CO₂ See PaCO₂
  alveolar deadspace 4, 83, 170, 196,
  200, 226, 315
  acute respiratory distress syndrome
    177
    causes of 177
    increased 196
    gas embolism 205
    pulmonary embolism 201
    alveolar deadspace fraction 190
    alveolar ejection volume See Va
    alveolar gas equation 122, 226
    alveolar hyperventilation 117
    alveolar hypoventilation 15
    alveolar minute ventilation 150, 152,
    233
    alveolar O₂ See PaO₂
    alveolar plateau 85, 329
    missing 92
    alveolar recruitment 161
    alveolar ventilation 165
    monitoring 12
    neonates 83
    relationship to PaCO₂ 39
    American Heart Association 20, 64,
    192
    American Society for Testing and
    Materials (ASTM) 373
    American Society of
    Anesthesiologists 43, 64
    American Society of Anesthesiology
    Closed Claims Study 37
    American Society of Gastrointestinal
    Endoscopy
    Clinical Outcomes Research
    Initiative (CORI) 105
  amino acids 240
  anatomic deadspace 83, 196
  anesthesia 43
  airway establishment 48
  and CO₂ production 242
  atelectasis 166
  analising circuit 45
  capnography 320
  equipment 44
  cardiovascular surgery 50
  general 103
  intraoperative events
    cardiopulmonary bypass 246
    laparoscopy 244
    temperature 246
    tourniquet release 245
    vascular cross-clamping 245
  laparoscopy 49
  morbidity 104
  neurosurgical 49
  one-lung ventilation 49
  position-related problems 48
  ventilation during 43
  anion gap See metabolic acidosis
  antacids
  false-positive CO₂ estimates 59
  anthropogenic effect 262
  antialagogues 41
  anxiolysis 103, 108
  anxiolytics 43
  aortic body 117, 360
  aortic pulse pressure 66
  aortic surgery 51
  APACHE 63
  apnea 16, 26, 34, 58
  central sleep 256
  conscious sedation 108–09
  apnea test for brain death 290
  ARDS See acute respiratory distress
  syndrome
  arterial blood gases 297
  arterial carbon dioxide partial
  pressure See PaCO₂
  arterial CO₂ tension See PaCO₂
  arterial gas embolism 122–23
  arterial–alveolar gradient 56
  arterial-to-alveolar PCO₂ gap 235
asthma 5, 48, 196, 330, 332
arterial–alveolar gradient 56
biofeedback 131
rationale 131
results 131
CO₂ monitoring 58
hypocapnia 127
waveforms 465
atelectasis 145
anesthesia-induced 166
atmospheric gases 261
atmospheric monitoring 261–69
closed ecosystems 265
mines 263
saturation diving 265
SEALAB experiments 265
alveolar–arterial pressure 115
changes in 68
ATP 239
Australian Incident Monitoring Study (AIMS) 39
Avogadro’s law 289
Badische Anilin und Soda Fabrik (BASF) 418
bag-valve mask 19
Barter syndrome 306
bases 295
Beckman metabolic measurement cart 424
Beer–Lambert law See Lambert–Beer law
bicarbonate 240
during cardiopulmonary resuscitation 187
regulation 296
bicarbonate buffers 295
bicarbonate infusion 288
bicarbonate–carbonic acid equation 295
bi-level ventilation 141
biofeedback 127–33
asthma 127, 131
epilepsy 128
hyperventilation syndrome 128
panic disorder 127, 129
principles and perspectives 132
Bios-3 265
Biosphere 2 266
birds, capnography 276
Black, Andrew 459
blackdamp 263
Bland–Altman plot 212, 215
blood transfusion
decision hemodynamics 219
Bohr equation 59, 65, 83, 198
Bohr, Christian 417, 421
Bohr–Enghoff equation 84, 165
Bouger, Pierre 416
Boyle, Robert 415
Boyle’s Law of Pressure and Volume 121
brain
CO₂ effects 252
brain death
apnea testing 290
brain injury, traumatic 66, 72
breath detection 392
breath sounds
auscultation 22
patients in transit 63
breathing circuit 45
integrity 56
during transit 64
dynamic end-tidal forcing 363
frequency response of respiratory controller 363
hypercarnic ventilatory response 362
physiology 360
pseudorandom binary forcing 364
response to transient CO₂
inhalation 362
British Standards Institute (BSI) 373
bronchiolitis 58
bronchodilators 174
bronchopleural fistula 34
bronchospasm 26, 330
Buteyko breathing technique 128
calcium metabolism 246
calibration 380
colorimetry
direct 241
indirect 241
capacitance equation 215
capnogram
analysis of 432
church-steeple appearance 47
origins of 432
capnography 1, 27, 226, 329–37
advances in 148
alpha angle 13
applications 432
beta angle 13, 319
cardiopulmonary resuscitation 185–92
clinical uses 12
conscious sedation 105
definition 23
detotracheal tube placement 64
history 455
monitoring
air embolism 444
circulation 437
medical errors 442
metabolism 432
technical defects 441
ventilation 433
neonate
devices 80
emergency medicine and transport 85
intensive care 86
mainstream and sidestream
measures 81
operating room 84
response time 90
safety 86
sampling rate 91
small airways 91
technical limitations 89
out-of-hospital setting 24–27
patients in transit 63–68
pulmonary embolism 195–205
sleep disorders 96–100
time-based See time-based capnography
veterinary medicine 276
volume-based See volume-based capnography
waveforms
biphasic 40
use of 76
capnography head-up tilt test
(CHUTT) 16
capnometry 27
at altitude 124
colorimetric 75
conscious sedation
modified nasal cannula 106
definition 23
detotracheal tube placement 64
quantitative 75
semiquantitative 75
sleep disorders 97
capnometry-assisted respiratory training See biofeedback
carbohydrate metabolism 239
carbon dioxide 239–47, 415
absorbers 151
balance 151, 240
elimination 151
embolism 663, 922
exhaled 11, 226
increased partial pressures 288
apnea testing for brain death 290
bicarbonate infusion 288
inhalation test 362
measurement 381–93, 417
algorithms 392
carbon dioxide 417
colorimetric detectors 385
early clinical applications 420
infrared absorption 382
mainstream/sidestream capnography 388
mass spectroscopy 386
Index

photoacoustic spectroscopy 385
physical 418
metabolic changes affecting 54
cardiovascular function 54
respiratory function 55
monitoring 226
and ambient pressure 124
asthma 58
neonates 58
non-invasive 149
spontaneously breathing patients 58
tissue levels 235
pathophysiology 283–86
physical properties 381
production 60, 239–40
anesthesia 242
biochemistry/physiology 239
calorimetry 241
intraoperative events 244
reduced partial pressures
carbonic anhydrase disorders 286
mitochondrial disorders 283
regulation 295
respiratory stimulation 118
stores 240
tissue/organ effects 250–56
central nervous system and brain 252
central sleep apnea 256
circulatory system and heart 254
oxygen delivery 252
respiratory system 253
splanchnic perfusion 252
vascular effects 255
transport 162, 225
volume 407, 417
carbon monoxide 263
carbonated beverages
false-positive CO2 estimates 39, 64
carbonic acid 295, 416
carbonic anhydrase disorders 286
acquired 288
inherited 287
cardiac arrest 54, 438
out-of-hospital 185, 191
patients in transit 66
PtcCO2 185–92
and prognosis 188
cardiac arrhythmias 119
cardiac compression 444
cardiac output 65, 208–23, 331
animal models 347–53
capnodynamic monitoring 215
complete rebreathing CO2, Fick Qc method 208
determination of 336
partial rebreathing CO2, Fick Qc method 210
findings 211
patients in transit 66
thermal dilution 210
cardiogenic oscillations 3, 7, 437, 465
cardiopulmonary bypass 51, 246
weaning from 146
cardiopulmonary resuscitation 33, 185–92, 465
bicarbonate and epinephrine 187
coronary and cerebral perfusion 187
cardiopulmonary system
high-altitude changes 119
cardiovascular function
and CO2 54
cardiovascular surgery
anesthesia 50
carnitine palmitoyltransferase II
deficiency 283
carotid body 117
carotid pulse 186
cassava, cyanide in 285
cats, capnography 273
cattle, capnography 274
Centers for Disease Control (CDC) 262
central atmosphere monitor 269
central nervous system
CO2 effects 252
high-altitude changes 120
central sleep apnea 256
central venous pressure 208
cerebral edema
high altitude 120
cerebral perfusion pressure 187
Charles, Jacques Alexander Cesar 415
Charles’ Law of Temperature 121
chemical buffering 295
chemoreceptors 360
chemoresponsiveness
measurement of 363
spontaneous variations in ventilation 366
ventilatory stability 366
chest wall disorders 99
children
conscious sedation 105
sedation 15
seizures
respiratory monitoring 16
chokedamp 263
chokes 123
chronic fatigue syndrome
occult hyperventilation 15
chronic obstructive pulmonary disease
48, 196, 201, 319, 330, 356
circulation, monitoring of 437
citric acid cycle 240
Clapeyron, Émile 415
climate
extremes of 116
clonidine
and response to anesthesia 243
closed ecosystems 265
Bios-3 265
Biosphere 2 266
International Space Station 267
Space Shuttle 266
submarines/submersibles 268
Cobra Perilaryngeal Air 19
colorimetric capnometers 11, 32
colorimetric capnometry 75
colorimetric CO2 detector 16, 385
semiquantitative 24
Comité Européen pour Normalisation (CEN) 373
compensation equations 299–300
complete rebreathing 208
compliance, pulmonary 11
computed tomography 162
gestive heart failure 222
combined sedation 103
airway obstruction 108–09
apnea 108–09
capnography 102–11
acceptance by providers 110
acceptance by regulatory agencies 110
vs. observation 110
children 105
definition of 103
guidelines 102
history 104
hypercarbia 110
hypoventilation 108
hypoxemia 109
pulse oximetry 107
sampling devices 107
ventilatory compromise 108–09
ventilatory depression 105
constant current anemometer 403
constant temperature anemometer
continuity equations 215
continuous “waveform” capnography 25
convection 162, 340
coronary artery bypass graft 212, 245
coronary perfusion pressure 187
Cumming, Gordon 458
curate cleft 3, 55, 464
Cushing syndrome 306
cyanide 284
biochemistry 284
poisoning 285
source 55
cytochrome c 285
Dalton’s Law of Partial Pressure 121
Davenport diagram 299
Davy’s Lamp 264
D-dimer test 200
Index

deadspace 89, 195, 421
alveolar See alveolar deadspace
anatomic See anatomic deadspace
dynamic apparatus 137
evaluation of 335
Fletcher's calculation 92
physiological See physiological deadspace
ventilation 6, 56, 314
decompression sickness 122
deep sedation 103
dexamethasone
high-altitude complications 120
diabetic ketoacidosis 58, 250, 296
diaphragmatic hernia 87
difficult airway 34
diffusion 162, 340
diving 122
saturation 265
dogs, capnography 273
dolphins, capnography 279
double-lumen tube ventilation 40
Douglas bag 80, 421
Duchenne muscular dystrophy 284
dynamic end-tidal forcing 363
dysxia 231, 235
dyspnea 127
echocardiography
transesophageal 186, 205
electrical impedance tomography 162
electroencephalography 96
electromagnetic interference 379
electromagnetic radiation 379
electromyography 96
dephyma 330, 356
dynamic measurement 33
dynamic tube
confirmation of placement 39
endoscopy 16
endotoxin-induced lung injury 253
dynamic intubation 19
blind placement 40
confirmation of 32, 37–38
out-of-hospital setting 20–21
patients in transit 63
positioning
false-negative CO2 assessment 33
false-positive CO2 assessment 33
monitoring of 56
dynamic tube
kinking of 56
leak 65
occlusion of 56, 65
placement 148
Endotrol® tube 38
end-tidal CO2 See PrrCO2
ergy expenditure 242
ergy production 240
enteral feeding tubes
placement 16
enteric tubes
avoidance of airway intubation 34
epidural anesthesia 243
epilepsy 433
hypocapnia 128
epinephrine
and cardiopulmonary resuscitation 187
and gas exchange 244
equal area method 340
erthropoietin
high-altitude changes 119
esophageal CO2 detection 38
esophageal detector device 22, 27
esophageal gastric airway 19–20
esophageal intubation 64
unrecognized 21–22, 37
auscultation of breath sounds 22
chest rise and fall 22
direct visualization 21
pulse oximetry 22
esophageal obturator airway 19
esophageal–tracheal combitube 19
ethylene glycol poisoning 303
etomidate 49
Euler–Lagrange equation 355
exercise 241
expiration
incomplete 93
extrapulmonary arterial pressure (EPAP) limit 139
extrapulmonary time-constant 164
extrapulmonary valve incompetence 46
extubation 155
unplanned 64
neonates 86
face masks 137, 139
selection of 138
use of 138
fiberoptic bronchoscope 34
fibrecapnic intubation 41
Fick principle 208
Fick's law of diffusion 162
fiberdamp 263
Food and Drug Administration (FDA) 44, 373
functional residual capacity 48, 330–31
gas analyzer
improper calibration 2
gas diffusive resistance 353–57
gas embolism 204
gas exchange 11, 163
anesthesia effects 243
gas flow 397–404
calibration 410
clinical issues 397
differential pressure flow sensors 408
fixed orifice type 402
Fleisch type 400
hot-wire flow sensors 402
Silverman and Whittenberg/Lilly modification 401
turbulent flowmeters 402
variable orifice type 401
distal
and proximal gas measurement 410
factors affecting readings 398
gas conditions 398
humidity 399
inlet conditions 399
operating range of flow sensor 400
resistance 400
sensor location 398
temperature 399
mainstream 410
measurement site conditions 408
measurement technologies 400
proximal
and gas measurement 409–10
signal processing 410
ultrasonic sensors 404
volume 397
gas laws 121, 415
Boyle's Law of Pressure and Volume 121
Charles' Law of Temperature 121
Dalton's Law of Partial Pressure 121
General Gas Law 121
Henry's Law of Solubility 121
Gay-Lussac, Joseph Louis 415
general anesthesia 103
General Gas Law 121
Gitelman syndrome 306
glucose oxidation 239
glutamine, catabolism 241
glycerol 239
Greek, Otto von 415
gas embolism 204
fixed damp 263
gas analyzer
improper calibration 2
gas diffusive resistance 353–57
gas embolism 204
gas exchange 11, 163
anesthesia effects 243
gas flow 397–404
calibration 410
clinical issues 397
differential pressure flow sensors 408
fixed orifice type 402
Fleisch type 400
hot-wire flow sensors 402
Silverman and Whittenberg/Lilly modification 401
turbulent flowmeters 402
variable orifice type 401
distal
and proximal gas measurement 410
factors affecting readings 398
gas conditions 398
humidity 399
inlet conditions 399
operating range of flow sensor 400
resistance 400
sensor location 398
temperature 399
mainstream 410
measurement site conditions 408
measurement technologies 400
proximal
and gas measurement 409–10
signal processing 410
ultrasonic sensors 404
volume 397
gas laws 121, 415
Boyle's Law of Pressure and Volume 121
Charles' Law of Temperature 121
Dalton's Law of Partial Pressure 121
General Gas Law 121
Henry's Law of Solubility 121
Gay-Lussac, Joseph Louis 415
general anesthesia 103
General Gas Law 121
Gitelman syndrome 306
glucose oxidation 239
glutamine, catabolism 241
glycerol 239
grey gases 261
Guericke, Otto von 415
Haldane, John Scott 417
halothane 49
Hamberger effect 295
harp seals, capnography 279
head injury 66
heart
CO2 effects 254
heliox 265
hemodynamic preconditioning 161
Henderson–Hassebalch equation 296, 385
Henry's Law of Solubility 121, 265
Herschel, William 416
469
Index

high altitude 116
acute mountain sickness 120
cardiopulmonary changes 119
early hypoxia response 117
hematologic changes 119
hypoxic respiratory stimulation 117
lung volume increase 118
neurologic changes 120
high-frequency oscillation 173
high-frequency ventilation 173
jet 52, 173
percussive 174
positive pressure 173
high-pressure environments 115–25
history 424–26
clinical capnography 430–55
volume-based capnography 457–60
Hooke, Robert 415
horses, capnography 274
hospital setting
airway management 32–35
hot-wire anemometers 400, 403
constant current 403
constant temperature 403
Hutchinson, John 420
hydrogen sulfide 263
hyperlactosteronism 306
hyperbaric chambers 123, 125
hyperbaric exposure 120
pulmonary effects 122
hypercapnia 11, 250–51, 296
and brain injury 252
and cardiac performance 255
and lung injury 253
endotoxin-induced 253
cerebral blood flow 253
ischemia–reperfusion injury 254
myocardial effects 254
nocturnal 58
hypercapnic acidosis 253
hypercarbia 99
conscious sedation 110
hyperkalemia 306
hyperpyrexia See hyperthermia
hyperthermia 246
malignant 8, 246, 459
hyperventilation 7, 66, 118, 229, 241
alveolar 117
avoidance of 72
PrrCO2, role in 73
hypercapnic 252
occult 15
waveforms 463
hyperventilation syndrome 128, 309
hypocapnia 11, 66, 74, 127, 250, 296, 308
altitude exposure 256
and brain injury 252
and lung injury 253
asthma 127
epilepsy 128
myocardial effects 254
panic disorder 127
hypocapnic alkalosis 252–53
hypokalemic acidosis 305
hypoplastic left heart syndrome 58
hypotension 54, 437
dangers of 446
vasodilation-induced 216
hypothermia 246
hypoventilation 45, 66, 99, 226, 241, 296
alveolar 15
and sedation 66
conscious sedation 108
nocturnal 100
waveforms 462
hypovolemia 54, 65, 217, 251
hypoxemia 16, 74
conscious sedation 109
in children 15
hypoxic pulmonary vasoconstriction
reflex 162
ice core analysis 262
inferior vena cava compression 117
infrared absorption spectroscopy
See infrared detectors 384
double-beam-in-space 384
double-beam-in-time 384
Lu/t design 384
non-dispersive 384
infrared radiation 382
absorption 382
chopper 385
pressure broadening 383
sources 384
infrared spectroscopy 80
inspiration
decreased CO2 at start of 85
inspiratory baseline 85
inspiratory valve incompetence 46
intensive care
neonates 86
International Electrotechnical
Commission (IEC) 373
International Liaison Committee on
Resuscitation 192
International Organization for
Standardization (ISO) 124, 373
International Space Station 267
intracranial pressure, raised 250
ischemia 231, 235
ischemia–reperfusion injury 250, 254
isoosmolar
as contaminant 377
Jonson, Björn 457
Kears–Sayre disease 283
ketoacidosis 302
alcoholic 302
diabetic 193
Konz 285
Krebs cycle 285
Krogh, August 417
Krogh, Marie 417
Kussmaul respirations 301
Kyoto Protocol 262
kyphoscoliosis 40
lactate 231, 239
lactic acidosis 302
lactulose 241
lactic acidosis 241
lipogenesis 240
Lesch–Nyhan syndrome 288
late deadspace fraction
and lung injury 253
lung function testing
and brain injury 252
and lung injury 253
Lu/t, Karl Friedrich 418
Lu/t,luck, Karl Friedrich 418
laryngeal tube airway 19
laparoscopy 244
laryngeal mask airway 19
Lambert–Beer law 384, 416
Lambert, Johann Heinrich 416
lactate 231, 239
lactic acidosis 302
lactulose 241
Lambert, Johann Heinrich 416
Lambert–Beer law 384, 416
laparoscopy 244
anesthesia 49
malignant minimization of 142–43
Leber optic neuropathy 283
Lesch–Nyhan syndrome 288
Leuenberg–Marquardt algorithm 341
licorice intake, metabolic alkalosis
306
lipogenesis 240
lipolysis 243
Liston, Max 423
Liston–Becker Company 423
loop gain 367
low-pressure environments 115–25
lower body negative pressure 235
luer connectors 378
Lu/t, Karl Friedrich 418
lung gas transport in 166
lung CO2, capacitance
compensation for 216
lung collapse 160
lung function testing
neonates 87
lung growth 92
lung injury
debreinent-induced 253
hypercapnia 253
hypocapnia 253
unilateral 172
Lung Injury Score 171
lung perfusion 163
lung recruitment 340–45
and CO2 kinetics 162
monitoring of 162
lung resection 323

© in this web service Cambridge University Press & Assessment

www.cambridge.org
lung transplantation 323
lung volumes 12
magnesium deficiency 306
hypokalemic alkalosis 305
mainstream capnography 1, 11, 47, 388–89
analyzers 390
neonates 81, 91
non-invasive positive pressure ventilation 138, 463
sleep disorders 97
Mainz Emergency Evaluation Scoring System 192
malignant hyperthermia 8, 52, 246, 459
mass balance equation 351
mass spectroscopy 386
magnetic sector–fixed detector 387
quadrupole mass filter 387
technical challenges 388
measurement accuracy 374
measurement drift 376
mechanical ventilation 169–78
acute respiratory distress syndrome 169
capnography in treatment evaluation 174
disconnection 45
extubation 155
high-frequency/percussive 173
leaks 46
lung collapse 160
minimization of 148–56
monitoring during 54–61
optimization 148–56
patient transport 56
phases of 149
tracheal gas insufflation 172
unilateral lung injury 172
waveforms 464
weaning from 57, 60, 154
failure of 153
importance of 153
neonates 87
medical errors 442
cardiac compression 444
nearly fatal pain stimulus 442
metabolic acidosis 299, 301
anion gap 301
causes 303
chloride-resistant 305
chloride-sensitive
drug-induced 305
high anion gap 302
decreased renal function 304
ketoadidosis 302
lactic acidosis 302
non-anion gap (hyperchloremic) 304
acid infusion 304
drug-induced 304
gastrointestinal 304
signs and symptoms 301
metabolic alkalosis 299, 304
alkali administration 305
causes 303
chloride-sensitive 305
gastrointestinal disorders 305
diagnosis 305
metabolic demand 241
metabolism 239
capnographic monitoring 432
methane 263–64
methanol poisoning 303
mice, capnography 275
microcapnometry 276
microstream capnography 15, 81, 106
midazolam
premedication 243
mill-wheel murmur 444
mines 263
mining accidents 263
minute ventilation 4–5, 52, 60
alveolar 150, 152
loss of 65
minute volume
anesthesia 242
mitochondrial disorders 283
acquired 284
inherited 283
monooxenohalome scrubbers 269
morbidity
anesthesia-related 104
multiple inert gas elimination technique 229, 315–16
muscle relaxants 464
effects of 435
onset time 216
NADH 231
narcotics 43
nasal cannula 106
nasal pressure monitoring 96
National Association of Emergency Medical Services Physicians 64
National Institute of Occupational Safety and Health (NIOSH) 263
neonates
alveolar ventilation 83
incomplete expiration 93
lung function testing 87
monitoring 80–93
normal respiratory values 5
Paco2, 83
Paco2, 83
sleep laboratory 88
therapeutic CO2 administration 58
weaning from mechanical ventilation 87
neuroleptic malignant syndrome 246
neuromuscular blockade 43, 244
neuromuscular disease 58, 99
neurosurgical anesthesia 49
NICO monitor 212–13, 216
nifedipine
high-altitude pulmonary edema 120
nitric oxide 116, 253
nitrogen dioxide 263
nitrogen narcosis 122
nitrogen washout 12
nitrous oxide 7
noxious oxide tracer 209
non-invasive positive pressure ventilation 135–43
acute respiratory failure 136
patient interfaces 137
patient selection 137
Paco2 monitoring 139
rebreathing 142
short-term vs. long-term use 142
sidestream vs. mainstream sampling 138
time-based capnography 135
volume-based capnography 135
Nordström, Lars 457
NPPV See non-invasive positive pressure ventilation
nutrient metabolism 239
obesity hyperventilation syndrome 99
Observer’s Assessment of Alertness/Sedation scale (OAA/S) 15
obstructive lung disease 320
obstructive sleep apnea 58, 98, 135
Occupational Safety and Health Administration (OSHA) 262
one-lung ventilation 49, 323
operating room
airway devices 19–20
airway management 19–29
detotracheal intubation 20–21
overventilation 66
oxidation 239
oxidative phosphorylation 239
oxygen 239
oxygen consumption 231, 239
biochemistry/physiology 239
oxygen delivery 231
tissues 252
oxygen saturation 14
oxygen toxicity 122
respiratory gas monitors (cont.)
  range 375
  response time 376
  types of 374
  respiratory quotient 232
  ... 416
  Van Helmont, Jan Baptista 415
  Van Slyke apparatus 418
  respiratory gas monitors (cont.)
vascular cross-clamping 245  
VCO₂  
age variation 243  
anesthesia effects 242   
VD shunt 165  
ventilation 165  
adequacy of 145  
consistency of 65  
in relation to perfusion 313  
PetCO₂-guided 72, 76  
prehospital  
capnography as guide to 72–77  
step changes 227  
weaning from  
postoperative 145–46  
ventilation/perfusion matching 136  
ventilation/perfusion mismatch 11, 55, 232, 313–25  
acute respiratory distress syndrome 322  
capnography 317  
clinical correlation 319  
low cardiac output state 324  
obstructive lung disease 320  
one-lung ventilation, lung resection and lung transplantation 323  
pulmonary embolism 324  
pulmonary fibrosis 323  
trauma 324  
ventilation/perfusion ratio 11, 40, 160, 169, 226, 330  
acute increase 227  
global increase. See hyperventilation  
regional increase 227  
declined pulmonary blood flow 228  
ventilator-associated lung injury 253  
ventilator disconnection 64  
ventilator-induced lung injury 154  
ventilatory failure 123  
ventilatory maldistribution 166  
ventilatory requirements, prediction of 60  
veterinary capnography 272–79  
acid–base values 275  
birds 276  
blood gases 275  
dogs and cats 273  
dolphins 279  
harp seals 279  
horses and cattle 274  
limitations of 272  
lung volumes 276  
reptiles 277  
respiratory parameters 274  
small laboratory animals 275  
species differences 273  
volume-based capnography 6–7, 11, 38, 148, 151, 333  
analysis 340–45  
clinical implications 344  
Fowler’s method 340  
cardiac output estimation 336, 347  
critical uses 59  
deadspace evaluation 335  
history of 423, 457–60  
lung recruitment 340–45  
neonates 82  
non-invasive positive pressure ventilation 135  
PEEP titration 340–45  
phase II deformation 334  
phase III deformation 334  
variables 342–43  
SₐO₂ 344  
veterinary medicine 272  
volutrauma 150  
wasted ventilation 195  
water trap 89  
artifacts 2–3  
waveforms  
normal 462  
real time and trend 462  
asymptomatic 465  
cardiogenic oscillations 465  
cardiopulmonary resuscitation 465  
faulty ventilatory circuit valve 464  
hyperventilation 463  
hypoventilation 463  
mechanical ventilation 464  
muscle relaxants 464  
non-diagnostic 463  
rebreathing 463  
sudden loss of expiratory CO₂ 464  
Wheatstone bridge 403  
Zuntz, Nathan 420