

Name		
	before exercise (4 min)	during exercise (12 min)
minute ventilation VE [l/min]		
O ₂ -uptake VO ₂ [lO ₂ /min]		
heart rate HF [1/min]		
skin temperature [°C]		
core temperature [°C]		
cycle power [W]		
oxygen debt[l]		
clearance of oxygen dept [l]		

Tab. 1: Measured values and results concerning O₂-balance (from program "Metasoft").

room temperature [°C]		
humidity [%]		
body height [cm]		
body mass [kg]		
body surface area BSA $BSA = \text{body mass [kg]}^{0,425} \cdot \text{height [cm]}^{0,725} \cdot 0,007184$	[m ²]	
body surface available for radiative heat exchange (0,5 · BSA)	[m ²]	
body surface available for convective heat exchange (0,3 · BSA)	[m ²]	
body surface available for evaporative heat exchange	[m ²]	before exercise (0,3 · BSA)
		during exercise (0,9 · BSA)

Tab. 2: Data collection for further calculations.

	before exercise	during exercise
metabolic rate MR [J/s]		
$MR [J/s] = (O_2\text{-uptake [l/min]} \cdot \text{caloric equivalent [kJ/lO}_2] \cdot 1000) / 60$ (caloric equivalent $\approx 20 \text{ kJ/lO}_2$)		
net efficiency [%]		
$\text{net efficiency [\%]} = 100 \cdot \text{cycle power [W]} / MR \text{ during exercise [J/s]}$		

Tab. 3: Calculation of the metabolic rates and net efficiency.

Calculate in table 4, how much heat is lost through radiation, convection and evaporation. Use the respective body surface available for heat exchange from table 3.

The differences in temperature / H₂O-vapor pressure are to be gathered between skin and air. See provided detailed formulas for heat loss.

	before exercise	during exercise																		
radiative heat loss rate [J/s]																				
<i>radiative heat loss rate [J/s] = 6 [J/(m² · s · K)] · difference in temperature [K] · body surface available [m²]</i>																				
convective heat loss rate [J/s]																				
<i>convective heat loss rate [J/s] = 2,5 [J/(m² · s · K)] · difference in temperature [K] · body surface available [m²]</i>																				
evaporative heat loss rate [J/s]																				
<i>evaporative heat loss rate [J/s] = 40 [J/(m² · s · kPa)] · difference in H₂O-vapor pressure [kPa] · body surface available [m²]</i>																				
saturation vapor pressure E _s of H ₂ O-vapor at different temperatures T:																				
T [°C]	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
E _s [kPa]	2,06	2,20	2,34	2,49	2,64	2,81	2,98	3,17	3,34	3,54	3,76	3,98	4,22	4,49	4,75	5,03	5,32	5,62	5,94	6,27
<i>actual H₂O-vapor pressure = saturation vapor pressure · relative humidity.</i>																				
<i>Please use the humidity as stated from the hygrometer. Before exercise use the same value for skin and air. During exercise the relative humidity of the skin is presumed 100 %.</i>																				
heat retention during exercise [J/s]																				
<i>heat retention during exercise [J/s]</i> <i>= 3500 [J/kg · K] · body mass [kg] · (core temperature_{exercise} – core temperature_{rest} [°C]) / 480 s</i>																				
Total body surface-associated heat loss [J/s]																				
amount radiation (of heat loss) [%]																				
amount convection (of heat loss) [%]																				
amount evaporation (of heat loss) [%]																				
amount of energy spent as heat [%]																				

Tab. 4: Calculation of body surface-associated heat loss