Q1: According to the Earth's energy budget provided by NASA, the fraction of solar energy absorbed by land and oceans is
Ans: 51%

Q2: According to life-cycle impact analysis of various ETS, the wind power performs best with respect to
Ans: Water consumption

Q3: In ultra-supercritical thermal power plants using water as the working fluid, the main steam pressure is:
Ans: Greater than 25 MPa

Q4: The measure how efficient the fuel thermal power is transformed into an added thermal power in a thermodynamic plant cycle is called
Ans: The boiler efficiency

Q5: The following improvements can still lead to higher energy efficiencies of thermal power plants:
Ans: Secondary reheat & Usage of pulverized coal-fired boilers

Q6: The aim of the Paris Agreement adopted in 2015 is that the increase in global average temperature, relative to the preindustrial level, should not exceed
Ans: 2 K

Q7: The recent progress in material engineering currently allows the main steam temperatures
Ans: Around 570 and up to 600 °C

Q8: Human transformation of energy (both production and use) accounts for about
Ans: 66% of total greenhouse gas emissions

Q9: "Bloom" in a water body can result from
Ans: Increased levels of nutrients & Eutrophication

Q10: When steam reheating is employed in the Rankine cycle, steam after leaving the high-pressure turbine is directed to
Ans: A boiler

Q11: The phenomenon of reflection of fraction of incident radiation is known as
Ans: Albedo

Q12: The main reason to employ regeneration in the Rankine cycle is to
Ans: Improve the plant cycle efficiency

Q13: Current concentration of CO_2 in the Earth's atmosphere has reached about
Ans: 400 ppm

Q14: Ongoing decrease in the pH of the Earth's oceans caused by the uptake of CO_2 is called
Ans: Ocean acidification

Q15: The radioactivity of spent fuel from a PWR, with initial enrichment of 4.5% and burnup of 50 MWd/kg HM reaches the same level as natural uranium after
Ans: 1.5×10^5 years

Q16: The internal turbine efficiency is defined as a ratio of
Ans: The internal to theoretical turbine power

Q17: Useful pumping power, in comparison with the internal pumping power, is
Ans: Always smaller

Q18: Assuming that Earth is absorbing all solar radiation (1366 W/m^2) and it behaves as perfect black body (Stefan-Boltzmann constant $s=5.67 \times 10^{-8} W/m^2/K^4$), at radiative equilibrium, the Earth surface temperature is approximately equal to
Ans: 279 K

Q19: The main reason to employ steam reheating in the Rankine cycle is to
Ans: Improve the cycle efficiency

Q20: A ratio of the useful pumping power to the internal pumping power is called
Ans: The internal pump efficiency

Q21: The power that can be captured by hydro power station with volumetric flow rate of water $Q=1\ m^3/s$ and drop height $H = 100$ m is equal to
Ans: About 1 MW

Q22: According to LCA by Turconi et al. (2013), greenhouse gas emissions from fossil fuels are greatest for
Ans: lignite

Q23: The energy output of a plant in its energy analysis includes
Ans: Net energy produced over the lifetime

Q24: Data acquisition approach in LCA that is called "Input-output analysis" (IOA) is:
Ans: A top-down approach based on monetary data for individual economic sector

Q25: Energy Requirement of Energy is defined as
Ans: The sum of all primary energies required to yield one unit of delivered energy

Q26: The current regulatory framework for a Life Cycle Assessment is defined by
Ans: ISO standards

Q27: Pelton turbine is an example of the
Ans: Impulse turbine

Q28: The impulse turbine achieves the maximum possible power when the ratio of the water jet velocity to the bucket velocity on the rotor wheel is
Ans: 2

Q29: Large hydraulic turbines can achieve efficiency
Ans: Above 90 %

Q30: According to LCA by Turconi et al. (2013), greenhouse gas emissions from direct combustion of hard coal is in a range
Ans: 750-1050 kgCO_2-eq/MWh

Q31: The maximum power of the impulse turbine, when assuming all other parameters constant, is changing with the water jet velocity Uj as:
Ans: Const*U_j^3

Q32: Francis turbine is an example of the
Ans: Reaction turbine

Q33: The ratio of the energy output to the corresponding energy input is known as
Ans: Energy Ratio & Energy Gain Ratio & Energy Payback Ratio

Q34: Life Cycle Assessment of a process can in particular provide identification of
Ans: Energy and material inputs of the process & Environmental releases of the process

Q35: For hydraulic turbines the efficiency is defined as a ratio of
Ans: The mechanical power to the hydraulic power

Q36: For the optimum power of the impulse turbine station, the total head loss should be equal to
Ans: 1/3 of the gross head available at the site

Q37: According to LCA by Turconi et al. (2013), greenhouse gas emissions from combined cycle of natural gas is in a range
Ans: 350-410 kgCO_2-eq/MWh

Q38: Life Cycle Assessment of a process
Ans: Is carried out by iteration of 4 processes

Q39: A turbine in which the working fluid comes to the turbine under pressure and the energy is extracted by the turbine blades from the working fluid
Ans: Is called a reaction turbine

Q40: Net head definition for the reaction turbine installation takes into account
Ans: Velocity heads in the headwater and tailwater

Q41: According to the report on Projected Cost of Generating Electricity (2015), the LCOE* ranges for baseload technologies are
Ans: From 30 to 145 USD/MWh

Q42: International Energy Agency (IEA) and Nuclear Energy Agency (NEA) are releasing report on Projected Costs of Generating Electricity on a regular basis every
Ans: 5 years

Q43: The unit of microscopic cross section is
Ans: barn

Q44: When reactor is under-moderated and the temperature of coolant increases, then the effective multiplication factor is
Ans: decreasing

Q45: If the breeding ratio in a reactor is 1.45, the breeding gain of the reactor is
Ans: 0.45

Q46: In a critical reactor with natural uranium as fuel, for each 1000 neutrons absorbed in U-235, 280 neutrons are absorbed in resonances of U-238 and 420 neutrons are absorbed by U-238 at thermal energies. Assuming no neutron leakage from the reactor, the conversion ratio is
Ans: 0.70

Q47: External breeding ratio is describing the breeding of fuel
Ans: In the blanket

Q48: The most relevant figure of merit to determine the usefulness of any material as a moderator is
Ans: The moderating ratio

Q49: The approximate number of fission products that emit delayed neutrons is
Ans: 40

Q50: Operation and maintenance cost of power plant typically consists of
Ans: Fixed and variable costs

Q51: Between years 2010 and 2015 LCOE* for solar PV
Ans: Significantly decreased

Q52: Neutrons emitted immediately after fission are called
Ans: Prompt neutrons

Q53: A new project to build a power plant will be financed in 60% with bonds with interest rate 4% and 40% with equity with interest rate 7%. What is a single interest rate for this investment?
Ans: 5.2%

Q54: The cost of the compensating electricity for variable technologies (wind and solar) is not taken into account in the report on Projected Cost of Generating Electricity because
Ans: There is no consensus how such costs should be taken into account

Q55: What is the capital cost of a plant that is constructed within 3 years with equal expenditure of 1 M€ at the end of each year. The interest rate is 5%. Use end of construction as the reference time point.
Ans: 3.1525 M€

Q56: An annual fixed charge of a power plant is equal to 1% of the total investment of 1M€. What is the levelized charge for electricity to cover the fixed charges if the plant's annual electricity production is 103 MWh?
Ans: 10€/MWh

Q57: One barn is equivalent to
Ans: 10^{-28} m^2 /nucleus & 10^{-24} cm^2 /nucleus

Q58: The resonance escape probability, with all parameters the same but increasing atom number density of uranium U-238 is:
Ans: decreasing

Q59: The total amount of money that has to be paid back at the end of a year, when borrowing amount C at the beginning of the year with interest rate i is
Ans: C*(1+i)

Q60: An annual expenditure to cover capital cost of a power plant is 250 k€ . The plant's annual electricity production is 103 MWh. What is the levelized charge for electricity to cover the capital expenditures?
Ans: 250€/MWh

Q61: The real efficiency for Darrieus wind turbines can reach up to
Ans: 40%

Q62: According to the Betz limit, the maximum power of a wind turbine, in relation to the total power theoretically available, is
Ans: 16/27

Q63: Wind speed variation with height z above the ground level is given by a
Ans: Logarithmic function of z

Q64: If u is a speed of a tip of a wind turbine blade and U is a wind speed, the ratio u/U is called a
Ans: Speed ratio

Q65: If U is wind speed, wind energy available for a given windmill is proportional to
Ans: U^3

Q66: The real efficiency for HAWT with 2 or 3 blades can reach up to
Ans: 50%

Q67: Sea breeze is when air flows
Ans: From a sea towards a land

Q68: Wind speed distribution (a histogram of hours versus wind speed) is well described by
Ans: Reyleigh distribution & Weibull distribution

Q69: When a wind turbine operates at the highest possible efficiency resulting from the Betz limit, the wind speed downstream of the wind turbine is equal to
Ans: 1/3 of the wind speed upstream of the turbine

Q70: Savonius wind turbine is the
Ans: Drag-based machine

Q71: The greatest losses in the solar thermal power system used for electricity generation results from
Ans: Thermal losses in Rankine cycle

Q72: The highest energy losses in photovoltaic systems are
Ans: Module losses

Q73: The mean heat flux resulting from sunlight at the Earth's orbit is called
Ans: Solar constant

Q74: A coefficient that defines the relative solar spectrum as compared to the spectrum when Sun is at the Zenith is called
Ans: Air mass coefficient

Q75: Evacuated-tube solar thermal collectors belongs to a group of
Ans: Medium-temperature collectors

Q76: The market-average efficiency of PV cells is in a range
Ans: 12-18%

Q77: The ratio of the maximum power output to the incident solar radiation power is called
Ans: Electrical efficiency & Conversion efficiency

Q78: Amorphous silicon thin film photovoltaics are usually termed as
Ans: 2nd generation photovoltaics

Q79: Most solar thermal collectors build in the first decade of 21st century operated with temperatures in a range
Ans: Up to 80 °C

Q80: Discrepancy between two kinds of solar time (direct-tracked Sun motion and mean solar time with noon 24h apart) is called
Ans: Equation of time

Q111: The isentropic (or internal) turbine efficiency is defined as a ratio of:
Ans: The internal to theoretical turbine power

Q112: Control mass system is defined as such a system that:
Ans: No mass can flow through its boundaries

Q113: The energy efficiency of an ideal Rankine cycle is approximately equal to the ratio of:
Ans: The theoretical turbine power to the added thermal power

Q114: Two Carnot cycles with the same heat extraction temperature $T_{e1} = T_{e2}$, and different heat addition temperatures $T_{a1} = 2*T_{a2}$ have efficiencies η_1 and η_2, where:
Ans: $\eta_1 = \eta_2/2 + ½$

Q115: The mechanical turbine efficiency is defined as a ratio of:
Ans: The effective to internal turbine power

Q116: Energy in transit from a system with higher temperature to a system with lower temperature is called:
Ans: The heat

Q117: The maximum work L_{max} of a Carnot cycle with efficiency η and where added heat is Q_a:
Ans: Is equal to $L_{max} = Q_a * \eta$

Q118: For a reversible adiabatic process in the control mass system the entropy:
Ans: Is unchanged

Q119: The following property is an example of the intensive property:
Ans: Temperature T [K] & Specific entropy s [J kg^{-1} K^{-1}]

Q120: The theoretical turbine power is such a power that can be calculated based on:
Ans: Assumption of isentropic steam expansion in the turbine

Q121: For an isobaric process of an ideal gas from state 1 to 2, with $T_2 = 2.7183*T_1$ the specific entropy will:
Ans: Increase approximately by c_p (specific heat at constant pressure)

Q122: For a given finite thermodynamic process, the maximum work can be determined by applying:
Ans: Both the first and the second principle of thermodynamics together

Q123: Energy that is available to be used as useful work is called:
Ans: exergy & Available energy

Q124: A phase transition from solid to gas is called:
Ans: sublimation

Q125: For an isobaric process from state 1 to 2, according to the first principle of thermodynamics, the heat change δ_q is:
Ans: Equal to enthalpy change $i_2 – i_1$

Q126: For an isothermal process of an ideal gas from state 1 to 2, where $p_2 = p_1/2.7183$, the specific entropy will:
Ans: Increase approximately by R (specific gas constant)

Q127: Energy transfer into a control mass system can take place by:
Ans: work & conduction

Q128: Energy associated with kinetic and potential energy of molecules in a body is called:
Ans: The internal energy

Q129: For control volume system, its boundary can be crossed:
Ans: By heat & By mass & By both heat and mass

Q130: For a given finite thermodynamic process from state (1) to state (2), the maximum work is:
Ans: Is less than the internal energy change $E_{I1} – E_{I2}$

Q131: For an isobaric process from state 1 to 2, according to the Gay-Lussac's law, the volume ratio V_1/V_2 is:
Ans: equal to temperature ratio T_1/T_2

Q132: The fundamental difference between the energy and the exergy of a system is that:
Ans: The energy is conserved but the exergy is not

Q133: The importance of the second law of the thermodynamics stems from the fact that it helps:
Ans: To search for systems with high thermodynamic efficiency & To search for entropy generation minimization in systems

Q134: Energy efficiency of the real Rankine cycle, when its ideal energy efficiency is equal to 0.5 and the turbine internal efficiency is equal to 0.8, is approximately equal to:
Ans: 0.4

Q135: The following property is an example of the extensive property:
Ans: Enthalpy I [J] & Internal energy E_I [J]

Q142: For a horizontal, frictionless and steady flow of incompressible fluid in a pipe with an increasing cross-section area in the flow direction, the pressure will:
Ans: Increase in the direction of flow

Q143: For flow of fluid in a channel with a sudden contraction, assuming the flow direction as a positive direction, the reversible and irreversible pressure changes:
Ans: Are both negative

Q144: The Fanning friction factor for laminar flow of fluid with Reynolds number Re, in a round tube, is:
Ans: $C_f = 16/Re$

Q145: Volumetric flow rates of water and air in a pipe are 1 m^3/s and 5 m^3/s, respectively. The total mixture volumetric flow rate is:
Ans: exactly 6 m^3/s

Q146: According to the Homogeneous Equilibrium Model, irreversible pressure loss at a local obstacle for two-phase mixture, when quality x=0.2 and density ratio ρ_f/ρ_g=26, in comparison to saturated liquid flow is:
Ans: exactly 6 times higher

Q147: For flow of fluid in a channel with a sudden expansion, assuming the flow direction as a positive direction, the reversible and irreversible pressure changes:
Ans: They have different signs

Q148: Void fraction calculated from the Drift Flux Model, in comparison to the void fraction calculated from the Homogeneous Equilibrium Mode is:
Ans: exactly the same only when $C_0=1$ and $U_{vj} = 0$

Q149: For viscous flow of fluid with mean velocity U, density ρ and wall shear stress τ_w, the Fanning friction factor is defined as:
Ans: $C_f = \tau_w / (\rho * U^2 / 2)$

Q150: Churn two-phase flow occurs when, in comparison to annular two-phase flow, the momentum of gas phase is:
Ans: lower

Q151: According to the Homogeneous Equilibrium Model, the void fraction of saturated water/steam mixture flowing in a channel with known mass fluxes for each phase can be uniquely determined only when:
Ans: pressure in the channel is known

Q152: For viscous flow of fluid with mean velocity U, density ρ and wall shear stress τ_w, the Darcy-Weisbach friction factor is defined as:
Ans: $\lambda = 4 * \tau_w / (\rho * U^2 / 2)$

Q153: Volumetric flow rates of water and air in a pipe are 1 m^3/s and 5 m^3/s, respectively. The mixture actual quality is:
Ans: unknown, since densities of water and air are not given

Q154: For two-phase saturated mixture flowing in a uniformly heated channel, the integral acceleration multiplier derived from the Homogeneous Equilibrium Model is:
Ans: none of the above

Q155: In a uniformly heated channel with constant cross-section area and constant heated perimeter, the thermodynamic equilibrium quality is:
Ans: Always increasing linearly with distance from inlet & always increasing with distance from inlet

Q156: For a horizontal, frictionless and steady flow of incompressible fluid in a pipe with constant cross section, the pressure will:
Ans: Remain constant along the pipe

Q157: For steady-state flow of incompressible fluid in a pipe, the mass flow rate W (kg/s):
Ans: Is always constant, that is W = const

Q158: For two-phase saturated mixture flowing in a uniformly heated channel, the integral gravity multiplier derived from the Homogeneous Equilibrium Model is:
Ans: always increases with increasing pressure & always decreases with increasing exit quality & never greater than 1

Q159: For laminar viscous flow with mean velocity U in a round tube with constant radius R, the wall shear stress is:
Ans: Proportional to U/R

Q160: The thermodynamic equilibrium quality and the actual quality are:
Ans: none of the above

Q161: For definition of a local loss coefficient at any obstacle with different downstream and upstream flow areas, it is customary to use as a reference:
Ans: The smaller of the two flow areas

Q178: Wall superheat is defined as a difference between
Ans: Wall and saturation temperature

Q179: Departure from Nucleate Boiling (DNB) occurs predominantly when the equilibrium thermodynamic quality is
Ans: Negative or slightly above zero

Q180: Temperature distribution for steady-state conduction in an infinite hollow cylinder with constant material properties is given by
Ans: Logarithmic function

Q181: Dryout occurs predominantly in
Ans: Annular flow regime

Q182: Inlet subcooling is defined as a difference between
Ans: Saturation and inlet temperature

Q183: For a pipe covered with an insulation layer with a critical thickness, the thermal losses, in comparison to uninsulated pipe, are
Ans: Maximum possible

Q184: For steady-state heat conduction in an infinite hollow cylinder, the heat flux on the inner surface, in comparison to the heat flux on the outer surface, is:
Ans: Always greater

Q185: According to the Levitan-Lantsman correlation, for two heated channels with the same mass flux and pressure but different internal diameters, dryout will first occur in the pipe with
Ans: none of the above

Q186: Onset of nucleate boiling (ONB) point in a heated channel is such a point where
Ans: Nucleate boiling appears

Q187: Correlations relevant to forced convection heat transfer have usually the following form: (Nu – Nusselt Number, Re – Reynolds number, Pr – Prandtl number, Ra – Rayleigh number)
Ans: Nu = f(Re, Pr, …)

Q188: For a specific solid body, with increasing heat transfer coefficient on the body surface, the corresponding Biot number (Bi):
Ans: Increases

Q189: Natural convection heat transfer is when fluid flow is
Ans: Driven by buoyancy forces

Q190: The lump thermal capacity model is a good approximation of exact behaviour when thermal conductivity of the body is:
Ans: Very large

Q191: The SI unit of thermal resistance is
Ans: Kelvin per watt

Q192: For an infinite cylinder with nuclear fission heating, the temperature at the centerline, in comparison with a case with uniform heating, is:
Ans: Always less

Q193: Temperature distribution for steady-state conduction in an infinite cylinder with constant material properties and uniform internal heat sources is given by
Ans: Parabolic function

Q194: Newton's equation of cooling gives a relationship between
Ans: Wall heat flux and a temperature difference between wall surface and fluid bulk

Q195: In post-CHF (critical heat flux) heat transfer regime, the heat transfer coefficient, in comparison to the convective boiling heat transfer regime, is:
Ans: Significantly smaller

Q196: Poisson differential equation can be applied to describe temperature distributions
Ans: For steady-state cases with internal heat source

Q197: Fourier law is concerned with a relationship between
Ans: Heat flux and temperature gradient