TUTORIAL ANSWERS WORK ENERGY POWER

Question 1

Mechanical power = mgh / time = (400)(9.81)(1200) / (2 x 60)
= 39 240 W

Efficiency = (P_{output} / P_{input}) x 100%

This case P_{out} is the mechanical power & P_{input} is the electrical power.

80% = (39 240 / P_{input}) x 100%

P_{input} = 49 050 W = 50 kW **(Answer: D)**

Question 2

Since mass M moved down a distance x, mass m has also moved up a distance x on the rough plane. Hence, work done against the frictional force is Fx. Thus, Fx is eventually the amount of heat generated by friction in this process. **(Answer: A)**

Question 3

By definitions power is also equals to Fv.

By using F = ma, total force applied to the body is

(F – mg sinθ) = ma

F = ma + mg sinθ

Power = Fv = (ma + mg sinθ)v = **mav + mgv sinθ** **(Answer: C)**

Question 4

Since air resistance is negligible, by conservation of energy, loss in K.E. is equal to the gain in G.P.E and vice versa. Thus answer is C

Question 5

Assume the body has mass m kg and the constant force applied is F N.

Power = Fv ; v = u + at; v = at, since u = 0.

Power = F(at) ; a = F/m

Power = F(F/m)(t) = (F^2/m)t

Since F and m are constant, thus power is directly proportional to t. **(Answer: E)**

Question 6

Assuming air resistance is negligible, the gain in K.E. of system = loss in P.E. of system

Gain in K.E. system = Loss in P.E. of Y – Gain in P.E. of X

= (5 x 9.81)(2.0) – (4 x 9.81)(2.0 sin 30°)

= 58.86 N = **59 N** **(Answer: B)**

Question 7

Total work done = 80 x 10 = 800 J

Work done against friction = 60 x 10 = **600 J** (thermal energy)

Work done converted to K.E = 800 – 600 = **200 J** **(Answer: C)**

Question 8

K.E. = ½ mv^2

Since object falling with constant speed,

mg = kv

v = mg / k

K.E. = ½ $m(mg / k)^2$ = $\mathbf{m^3g^2 / 2k^2}$ **(Answer: D)**

Question 9

K.E. will be constant and equal to ½ mv^2, since the velocity is constant.

P.E. will decrease at a rate of = mgΔh / Δt, and v = (Δh / Δt)

= mgv

So answer is A

Question 10

Power generated by the dynamo, at any instant, is given by the slope of the energy-time curve. From the graph, it is obvious that maximum power occurs during time interval from 2 to 3 seconds since the portion of graph (straight line) has the largest gradient.

Max. power = (0.4 – 0.1) / (3-2) = **0.30 W** **(Answer: C)**

Question 10

P_{out} / P_{in} x 100% = 40%

1000 M / P_{in} x 100% = 40%

P_{in} = **2500 MW**

Wasted power = 2500 M – 1000 M = **1500 MW (Answer: D)**

Question 11

P_{out} / P_{in} x 100% = 40%

1000 M / P_{in} x 100% = 40%

P_{in} = **2500 MW**

Question 12

Power = Energy / time

= mgs sinθ / t , v = s/t

= mgv sinθ (Answer: B)

Question 13

Total force developed by motor = (1000 + (1000 x 9.81)) = 10 810 N

Power = Fv = (10 810)(0.5) = 5 405 W = **5.5 kW** **(Answer: B)**