2021 Physics 105 Final Exam

Done by:
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Q1:Iodine (I^{131}) is widely used in the treatment and diagnosis of the thyroid gland. The radius (in fm) of this isotope is:

A)131.0
B)157.2
C)5.2
D)5.4
E)6.1
Answer: E

Q2:a 55-kg person has absorbed a 20-rad dose. How many joules of energy are deposited in his body?

A)1.1
B)20
C)11
D)55
E)1100
Answer: C

Q3: the activity of 1 gram of radium ($_{88}RA^{226}$) is exactly 1 Ci. The half-life of radium (in years) is:

A)226
B)1170
C)2280
D)1580
E)1950
Answer: D

Q4: A 70-kg researcher absorbs 4.5 x 10^8 neutrons in a work day, each of energy 1.2 MeV. The relative biological effectiveness (RBE) for these neutrons is 10. What is the equivalent dosage of the radiation exposure for this researcher, in mrem?

A)1.2
B)0.39
C)0.77
D)3.7
E)12
Answer: A

Q5: a 2.0-mCi source of ^{32}P is implemented in a tumor to give it a 24-Gy dose. The half-life of ^{32}P is 14.3 days, and 1mCi delivers 10mGy/min. How long (in min) should the source remain implanted?

A)12
B)1200
C)2400
D)300
E)800
Answer: B

Q6: Ionizing radiation can be used on meat products to reduce the levels of microbial pathogens. Assume that for refrigerated meat the upper allowed limit is 3.8 kGy. If a beam of electrons each of energy 1.6 MeV, irradiates 3.0 kg of beef, how many electrons should the beef mass absorb to reach the upper allowed limit?

A)3.8 x 10^{10}
B)4.5 x 10^{10}
C)3.8 x 10^{16}
D)4.5 x 10^{16}
E)1.6 x 10^{10}
Answer: D

Q7: A biological tissue of a mass m is exposed to 60 rad of alpha radiation. How many rads of slow neutrons can cause the same damage to the same tissue? (For alpha RBE=20 ,for slow neutrons RBE=5).

A)240
B)300
C)60
D)360
E)1200
Answer: A

Q8: A blood vessel of radius r splits into two smaller vessels, each of radius $r/3$. If the velocity in the larger vessel is v, then the velocity in each of the smaller vessels is:

A)9v
B)v/9
C)2v/9
D)v
E)9v/2
Answer: E

Q9: Water flows into the top floor of a 16-m high building through a pipe of constant 2 cm diameter. At the base of the building (ground level) the water flows into the pipe at a speed of 60 cm/s where the gauge pressure is 3.2 atm. The gauge pressure (in atm) in the pipe in the top floor is:

A)0
B)1.65
C)2.65
D)1.54
E)3.2
Answer: B

Q10: The surface of water in the tank supplying water ton a house is 7 m above the faucet (حنفية) in the house. If the faucet is 2.0-cm diameter, how long (in s) does it take to fill a 0.25-m³ container in the house?
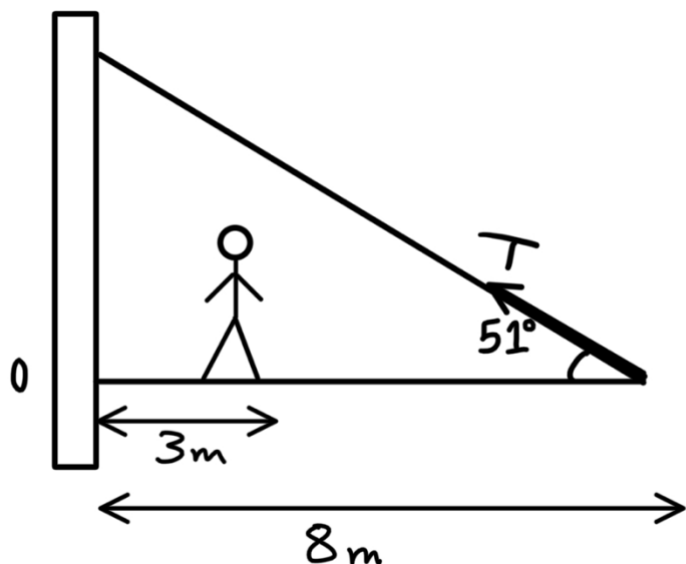
A)95
B)57
C)68
D)80
E)136
Answer: C

Q11: How much force (Fm in N) must the biceps muscle exert when a 5-kg madd is held in the hand with the forearm being in static equilibrium in horizontal position as in the figure. Assume that the elbow joint, O, is 5 cm far from the point of application of Fm, and that the mass of forearm and hand together is 2.0 kg:
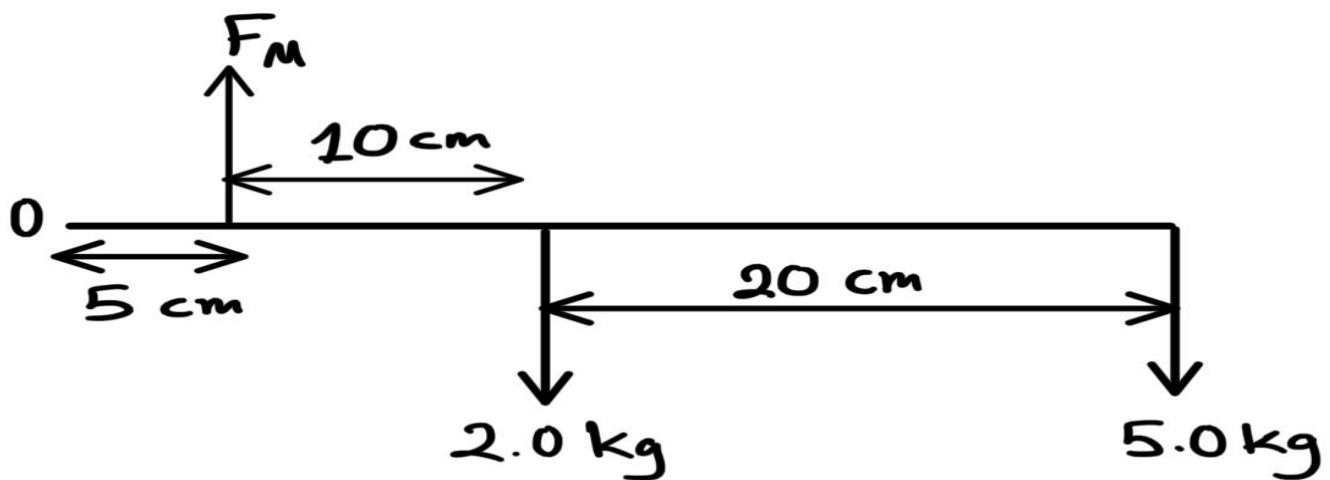
A)800
B)402
C)100
D)200
E)50
Answer: B

Q12: The figure above shows a uniform, horizontal beam (length=8 m, mass=25 kg) that is pivoted to the wall by a hinge at point 0, with its far end support by a cable that makes an angle of 51° with the horizontal. If a person (mass=60 kg) stands 3.0m from the pivot, what is the horizontal component of the hinge force (in N) acting at point O?

A)380
B)189
C)0
D)20
E)278
Answer: E

Q13: The kinetic energy of a car moving along a horizontal road is 130 kJ. The driver applies the breaks, and the car stops in 20 m, the force of friction (in N) (assumed constant) is:

A)260000
B)2600
C)130000
D)6500
E)1300
Answer: D

Q14: A 55-kg athlete climbs a 9 m long rope in 10 s. His average power is (in W):

A)231
B)485
C)550
D)90
E)331
Answer: B

Q15: A 4-kg mass is placed on a rough surface that makes an angle of 20° with the horizontal. If the mass is on the verge of motion, then the coefficient of static fraction (μ_s) is:

A)0.36
B)0.94
C)0.87
D)0.11
E)0.34
Answer: A

Q16: a student moves a 6 m along the positive x-direction, then he turns around and moves 9 m along the negative x-direction. His average velocity (in m/s) over the 7.0 total interval of motion is:

A)-3
B)0.43
C)0.75
D)3
E)-0.43
Answer: E

Q17: A stone is projected vertically upward with a speed of 12 m/s from the top of an 18 m high building. The time (in s) it takes the stone to reach the ground is:

A)4.1
B)0.1
C)3.5
D)3.0
E)0.6
Answer: C

IT DOES NOT MATTER HOW SLOWLY YOU GO
AS LONG AS YOU DO NOT STOP