

DOCTOR
2021

FINAL PHYSICS 105



Done by:
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Q1) Iodine ^{131}I 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

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

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

- A) 226
- B) 1170
- C) 2280
- D) 1580
- E) 1950

Q4) A 70-kg researcher absorbs 4.5×10^8 neutrons in a workday, 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

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

- A) 12
- B) 1200
- C) 2400
- D) 300
- E) 800

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?

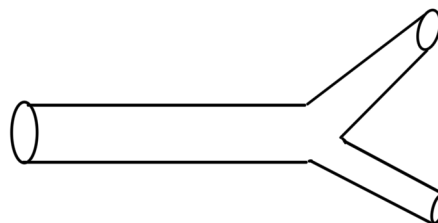
- A) 3.8×10^{10}
- B) 4.5×10^{10}
- C) 3.8×10^{16}
- D) 4.5×10^{16}
- E) 1.6×10^{10}

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

- 1) 240
- B) 300
- C) 60
- D) 360
- E) 1200

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 vessel is:

- A) $9v$
- B) $v/9$
- C) $2v/9$
- D) v
- E) $9v/2$



09) 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

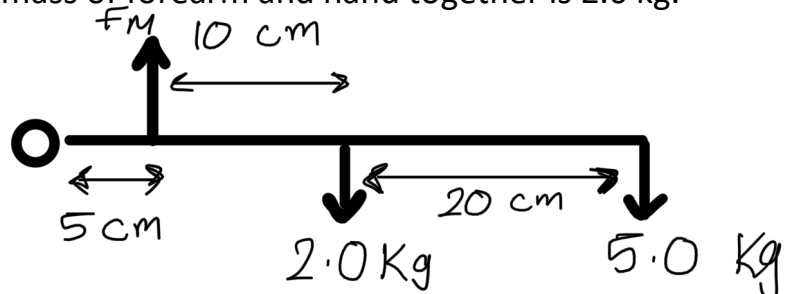
Q10) The surface of water in a tank supplying water to a house is 7 m above the faucet (حنفية) in the house. If the faucet is 2.0-cm diameter, how long (in s) does it take to fill a 0.25-m^3 container in the house?

- A) 95
- B) 57
- C) 68
- D) 80
- E) 136

Q11) How much force (F_M in N) must the biceps muscle exert when a 5.0-kg mass is held in the hand with the forearm being in static equilibrium in a horizontal position as in the figure. Assume that the elbow joint, O, is 5 cm far from the point

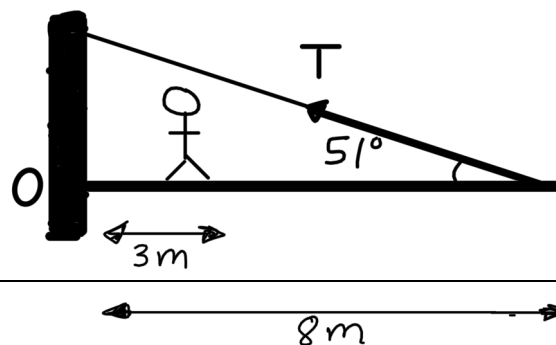
of application of F_M , and that the mass of forearm and hand together is 2.0 kg.

- A) 800
- B) 402
- C) 100
- D) 200
- E) 50



Q12) The figure shows a uniform, horizontal beam (length = 8 m, mass = 25 kg) that is pivoted to the wall by a hinge at point O, with its far end supported by a cable that makes an angle of 51° with the horizontal. If a person (mass = 60 kg) stands 3.0 m 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

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

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

- A) 231
- B) 485
- C) 550
- D) 90
- E) 331

Q15) A 4.0 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 friction (μ_s) is

- A) 0.36
- B) 0.94
- C) 0.87
- D) 0.11
- E) 0.34

Q16) A student moves 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 s total interval of motion is:

- A) -3
- B) 0.43

- C) 0.75
- D) 3
- E) -0.43

Q17) A stone is projected vertically upwards 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

ANSWERS:

Q1-E	Q2-C	Q3-D	Q4-A	Q5-B
Q6-D	Q7-A	Q8-E	Q9-B	Q10-C
Q11-B	Q12-E	Q13-D	Q14-B	Q15-A
Q16-E	Q17-C			