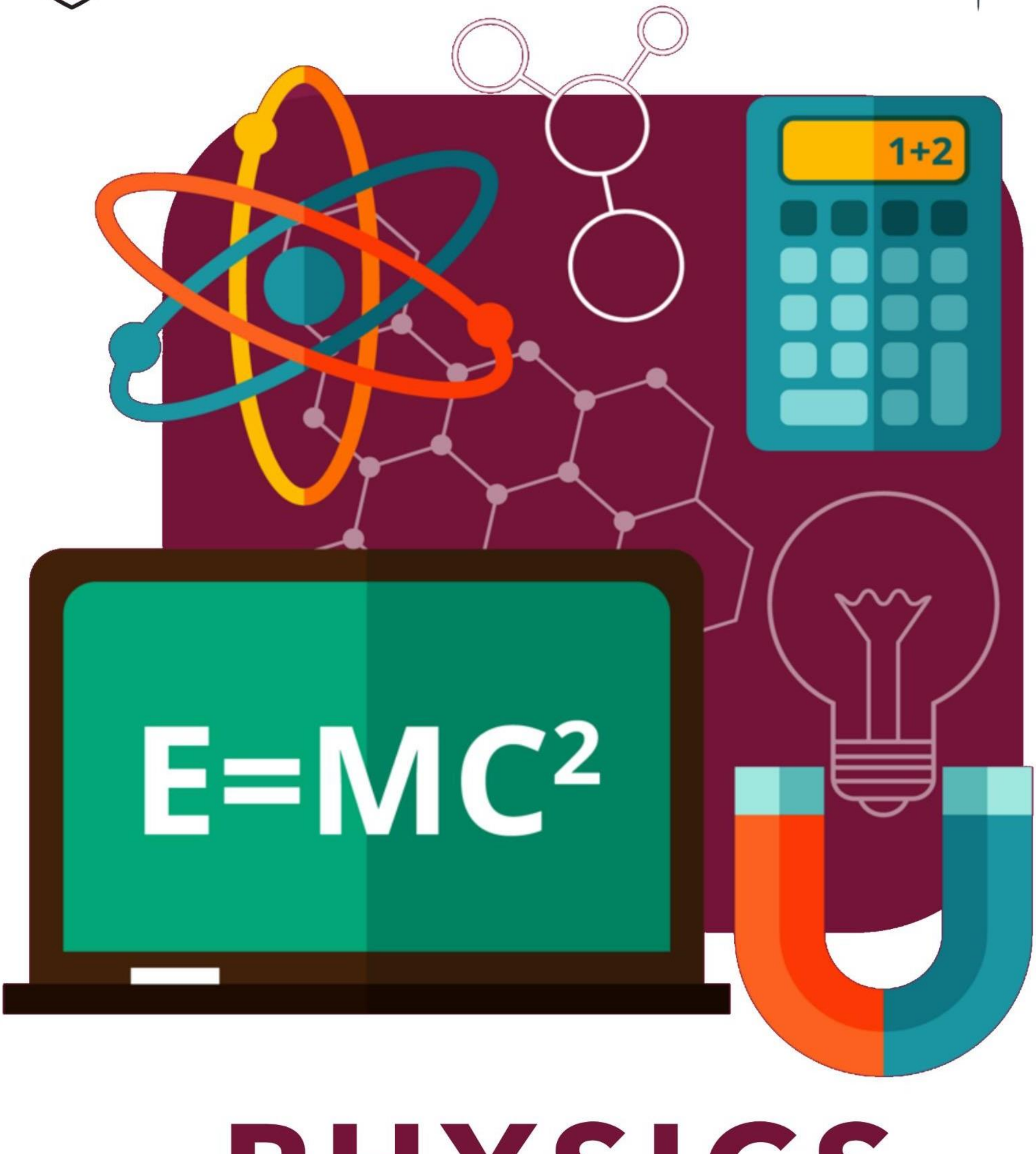
PAST PAPERS



PHYSICS

(CHAPTERS 30/31)

1. A beam of high energy α particles is incident upon a person and deposits 0.35 J of energy in 0.8 kg of tissue the dose equivalent (in rem) the person receives is: ($RBE_\alpha = QF_\alpha = 20$)

A) 34.8 B) 87.5 C) 438 D) 875 E) 219

2. A person ingests 0.63 μ Ci of a radioactive source. The emitter alpha particles deposit all their energy in the lungs. Given energy of each alpha particles is 4.0 MeV. Assume all the emitter alphas are absorbed within a 0.5 kg mass of tissue. The absorbed dose (in rad) for one year is :

A) 1900 B) 47 C) 955 D) 94 E) 150

3. The isotope, ^3He, has a half Life of 12.3 years. Assume we have 10.0 kg of the substance. The mass (in kg) of ^3He that will be left after 30 years is closest to:

A) 0.5 B) 0.2 C) 1.8 D) 4.2 E) 1.3

4. A radioactive sample with decay rate R and decay energy Q has a power output of:

A) Q/R B) Q^2/R C) R D) QR

5. A certain nucleus containing 8 protons and 7 neutrons a radius R. Which of the following value would be to the expected value of the radius of a nucleus having 51 protons and 69 neutrons?

A) 1.85R

B) 2.00R

C) 2.14R

D) 6.38R

E) 8.00R

6. At t=0 container holds equal number of atoms of phosphorus 30 with a half life of 2.5 minutes, and of nitrogen 13 with a half life of 10 minutes. After 20 minutes the ration of the number of nitrogen atoms remaining to the number of phosphorus atoms remaining (N/P) is:

A) 64 B) 1/64 C) 1/256 D) 8 E) 256

7. At t=0, A living piece of wood contains $6.5*10^{10}$ atoms of Carbon (A=14) per gram. A 44 g of a dead piece of wood is found in a forest. The dead peace shows a Carbon (A=14) activity of 100 decays/minutes. How long (in years) has this piece been dead?

The half-Life Carbon (A=14) of is 5730 years

A) 12300

B) 8500

C) 15600

D) 4700

E) 2400

8. The isotopes Ra (A=266) undergoes α decay with a half-Life of 1620 years. The activity (in Ci) of 1.00 g of Ra (A=266), is:

(1 Ci=$3.7*10^7$ Bq , NA=$6.02*10^{23}$)

A)1.96

B) 0.98

C) 10.0

D) 0.49

E) 5.00

9. A 67.0-kg person mistakenly ingests 0.35-ci of ^{3}He which emits electrons each with 5.0 keV. Assume that all of the electrons emitted from ^{3}He are absorbed uniformly throughout the body. The absorbed dose (in rad) for one week is: (1 Ci = $3.7 * 10^{10}$ Bq)

A) 9.35

B) 2.76

C) 27.6

D) 935

E) 7.46

There is no substitute for hard work.

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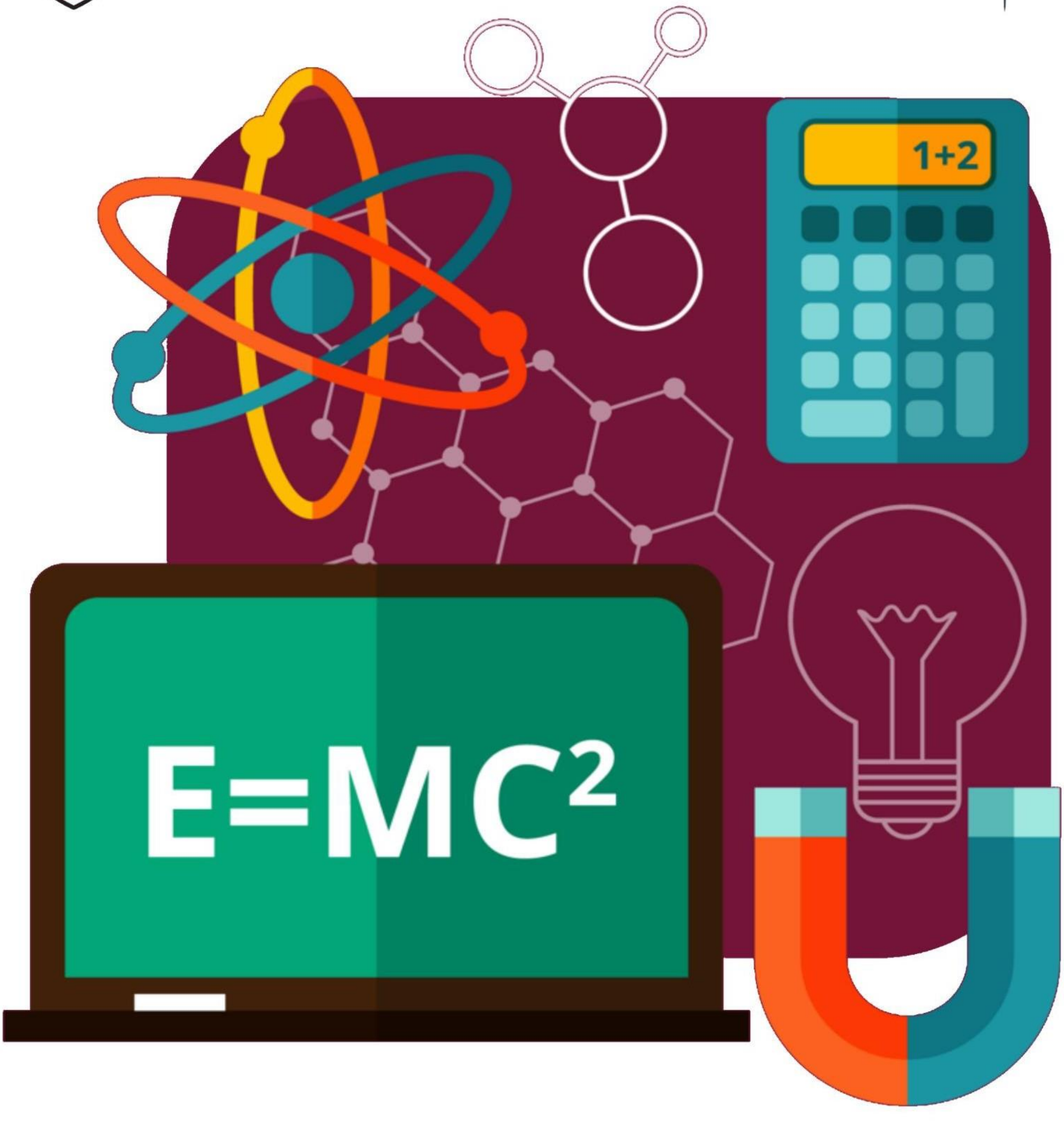

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Q7)

$N_0 = 6.5 * 10^{10}$ atom/g

$R = 100$ decay/min

$t = ??$

$T_{1/2} = 5730$ year

$$N = N_0 \left(\frac{1}{2}\right)^{\frac{t}{T_{1/2}}}$$

$$\frac{N}{N_0} = \left(\frac{1}{2}\right)^{\frac{t}{T_{1/2}}}$$ t ??

$N_0 = 6.5 \times 10^{10} \frac{\text{atom}}{\text{g}} \times 44\,\text{g} = 2.86 \times 10^{12}$ atom

$100 \frac{\text{decay}}{\text{min}} * \frac{1\,\text{min}}{60\,\text{sec}} = 1.66$ decay/sec

$T_{1/2} = 5730 * 365 * 24 * 60 * 60$

$T_{1/2} = 1.8 \times 10^{11}$ S

$$R = \lambda N = \frac{\ln(2)}{T_{1/2}} N$$

$$1.66 = \frac{\ln(2)}{1.8 \times 10^{11}} \times N$$

$N = 4.31 \times 10^{11}$

$$\ln\left(\frac{N}{N_0}\right) = \ln\left(\frac{1}{2}\right)^{\frac{t}{T_{1/2}}}$$

$$\ln \frac{N}{N_0} = \frac{t}{T_{1/2}} \ln\left(\frac{1}{2}\right)$$

$$\ln\left(\frac{4.5 \times 10^{11}}{2.86 \times 10^{12}}\right) = \frac{t}{5730} \ln\left(\frac{1}{2}\right) \rightarrow 15608.011 \text{ years}$$

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