PACE Jr Colleges, Prelim (I) 2013, Scheme for Physics

DEDUCT ½ MARK FOR NO OR WRONG UNIT EVERYWHERE.

Q. 1. 1. b – 1 sec

2. b – throughout increases

3. d – 8 % (I α MR^2& M α R^2, i.e., I α R^2)

4. b – $(An)^2$

5. d - centrifugal force > gravitational force

6. c – 2.5 cm

7. a – Should be concave

Q. 2. 1. Formula — 1 mark

Dimensions $(M^{-1} L^3 T^{-2})$ — 1mark

2. P. E. = - GMm/R — ½ mark

Substitution — ½ mark,

answer – 2.001×10^{11} J — 1 mark (1/2 mark for negative sign and for unit)

3. $MK^2 = I = (7/5)\, MR^2$ — 1 mark

$K = \sqrt{1.4}\, R$ — 1 mark

4. ½ mark each

5. 1 mark each (1/2 mark for proper symbols on axes)

6. As per answer (Any method, exact or approximate)

7. $T = \frac{f}{2(2\pi r)}$ — ½ mark

Substitution — ½ mark

Answer 50 dynes/cm — 1 mark

8. 1 mark each

Q. 3. 1. Figure is not essential. Meanings of symbols must be mentioned. Step wise marks.

2. Figure ½ mark. Stepwise 2.5 marks, starting with equation of source particle and then introducing negative phase difference.

3. N' = N$\left[\frac{v+v_o}{v-v_s}\right]$ ½ mark

$v_o = v_s = v_{train}$ = 10 m/s ½ mark

N' = 700 Hz 1 mark

f_{beats} = 40 Hz ½ marks

Beats not audible or not detectable ½ mark

4. Correct number of oscillations, per day = 86400/2 = 43200 ½ mark

Actual number of oscillations performed, per day 86400/1.98 = 43640 1 mark

Number of oscillations gained, per day = 43640 – 43200 = 440 ½ mark

Time gained, per day = 440 x 2 = 880 s 1 mark

Q. 4. A. Step wise marks (4)

B) $P.V^{\gamma}$ = constant ½ mark

γ = 7/5 = 1.4 ½ mark

Calculation 1 mark

Answer = 2.639 atm 1 mark

Q. 4. OR. A. Figure with directions of vectors ½ mark

Remaining 2.5 marks stepwise.

B. $I_1n_1 - I_2n_2 = (I_1 + I_2)n$ 1 mark

Answer = 5 rpm, in the sense of rotation of second wheel. 1 mark

Q. 5. 1. D – frequency

2. D – 1.732

3. A – $(M^{-1} L^{-2} T^{4} I^{2})$

4. D – Reactive circuit

5. C – GS/(G + S)

6. B – n^{-3}

7. A – Intensity of incident radiations

Q. 6. 1. Number of waves = $\frac{d_g}{\lambda_g} = \frac{12\ \mu m}{\lambda_a}$ 1 mark

Answer d_g = 8 μm 1 mark

2. Definition 1 mark

Gyromagnetic ratio = $e/2m_e$ = 8.8 x 10^{10} C/kg 1 mark

3. Each point, 1 mark.

4. Figure, 1 mark

Labelling, 1 mark.

5. 1 + ½ + ½ mark

6. Formula ½ mark, substitution 1 mark, answer 2 x 10^{-4} A (0.2 mA) ½ mark.

7. $d\theta = 1.22\ \lambda/D = 3.66 \times 10^{-7}$ radian.

Formula ½ mark, substitution 1 mark, answer ½ mark.

8. Formula ½ mark, substitution 1 mark, answer $\frac{1}{\sqrt{2}} = 0.7071\ g$ ½ mark.

Q. 7. 1. Limitations of Rutherford theory: ½ mark each.

How those are overcome in Bohr's theory (in postulate II and III): 1 mark each.

2. Any method, answer 2.016 V (E = 6.216 eV, ϕ = 4.2 V, i.e., answer 2.016 V)

3. $C = \frac{1}{4\pi^2\ f_0^2\ L} = \frac{1}{1000\pi^2} = 1.012 \times 10^{-4}$ F 2 marks

I = V/R = 3 A 1 mark

4. Diagram 1 mark 1 mark

Explanation of amplitude modulation 1 mark

Q. 8. I. Voltage across 3μF capacitor is 2 x (5/3) = 10/3 volts 2 marks

∴ Q = CV = 10 μC 1 mark

II. 'r' by potentiometer, figure 1 mark

Description **and formula** 3 marks

Q. 8. OR. A. Figures ½ mark, each

Description, 1½ mark each.

B. Voltage rating is unchanged during shunting ∴ V = 5 V 1 mark

S = G, ∴ Current range is doubled, ∴ I = 200 μA. 2 marks.