

## NEB - GRADE XII

2081 (2024)

## Physics

(New Course)

(For the regular and grade increment general stream's students whose first two digits of registration number starts from 78, 79 and 80)

Attempt all the questions.

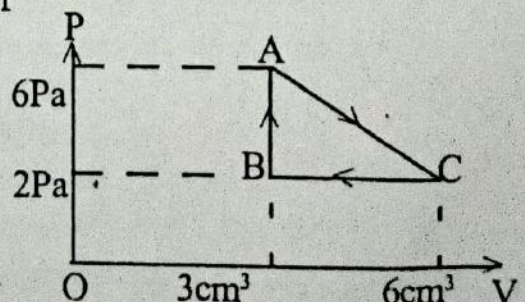
## Group 'A'

Rewrite the correct options of each questions in your answer sheet. [11×1=11]

- If the meniscus of a liquid kept in a glass tube is plane then what will be the value of angle of contact ?  
(A) zero (B) less than  $90^\circ$  (C) greater than  $90^\circ$  (D) equal to  $90^\circ$
- The period of oscillation of mass  $M$  suspended from a spring is 2 second. What will be the period if mass is equal to  $4M$  ?  
(A) 1sec (B) 2sec. (C) 4sec (D) 8sec
- A disc of moment of inertia  $I$  is rotating about an axis passing through its centre and perpendicular to its plane. If a small wax of mass  $m$  is dropped at distance  $r$  from the axis of rotation then what will be the new moment of inertia of the disc?  
(A)  $I$  (B)  $I - mr^2$  (C)  $I + mr^2$  (D)  $\frac{I}{mr^2}$
- An ideal heat engine working between temperatures  $T_1$  and  $T_2$  has efficiency  $\eta$ . If both the temperature are raised by 50K each, the new efficiency of engine will be  
(A)  $\eta$  (B) more than  $\eta$   
(C) less than  $\eta$  (D) depends upon the nature of working substance.
- An ideal gas is taken through series of changes represented in diagram. The workdone by the gas at the end of cycle is .

(A)  $6 \times 10^{-6} \text{ J}$ (B)  $12 \times 10^{-6} \text{ J}$ (C)  $3 \times 10^{-6} \text{ J}$ 

(D) 6J

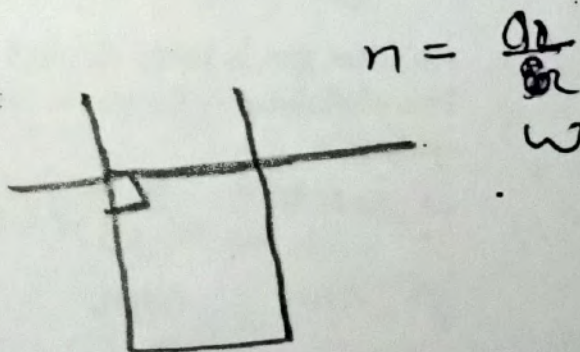


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6. In which of the following medium, the velocity of sound is highest ?  
 (A) Vacuum (B) Water (C) Hydrogen (D) Steel
7. Critical angle for a glass is  $42^\circ$ . What will be the polarizing angle for it ?  
 (A)  $30^\circ$  (B)  $45^\circ$  (C)  $56^\circ$  (D)  $65^\circ$
8. Study the following list of thermoelectric series and answer the question given below.  
 Sb, Fe, Zn, Pb, Mn, Cu, Bi  
 Which of the following combination would give the least emf ?  
 (A) Sb and Bi (B) Fe and Cu (C) Sb and Cu (D) Zn and Mn
9. Which of the followings can be explained by the area of the hysteresis curve ?  
 (A) retentivity (B) loss of energy per cycle  
 (C) coercivity (D) Curie's temperature
10. A charge of 2 coulomb is moving with velocity of  $0.5 \text{ ms}^{-1}$  at an angle of  $30^\circ$  in a magnetic field of 4T. What will be the magnetic force experienced by the charge ?  
 A) 1N B) 2N C) 4N D) 0.5N
11. Which of the earthquakes wave is first recorded on the sesimograph?  
 A) S-waves B) P-waves  
 C) Love waves D) Rayleigh waves

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Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Time: 3 hrs.

Full Marks: 75

Attempt all the questions.

## Group 'A'

Question No. 1 to 11 (Multiple Choice Questions) will be provided after 30 minutes of starting examination. Rewrite its (MCQ) correct options (answer) in the same answer sheet.

## Group 'B'

## Short answer questions.

[8×5=40]

12. a) Define moment of inertia. [1]
  - b) State principle of conservation of angular momentum with one example. [1+1]
  - c) A wheel starts from rest and accelerates with constant angular acceleration to an angular velocity of 8 revolutions per second in 5 seconds. Calculate :
    - i) angular acceleration and
    - ii) angle which the wheel has rotated at the end of 3 sec. [2]
- OR
- a) Define simple harmonic motion. [1]
  - b) Obtain an expression for frequency of oscillation of vertical mass spring system. [2]
  - c) A simple pendulum of effective length 4m swings with an amplitude of 0.2 m. Compute the velocity of pendulum at its lowest point. [2]  
[g = 9.8ms<sup>-2</sup>]
13. a) Define capillarity with two suitable examples. [2]
  - b) Water flows steadily through a horizontal pipe of non-uniform cross-section. If the pressure of water is  $4 \times 10^4 \text{ Nm}^{-2}$  at a point where the velocity of the flow is  $2\text{ms}^{-1}$  and cross-section is  $0.02\text{m}^2$ . What is the pressure at a point where cross-section reduces to  $0.01 \text{ m}^2$ ? Density of water is  $1000 \text{ kgm}^{-3}$ . [3]

## 1021'D'

(2)

14. a) Adiabatic process is the thermodynamic process in which the heat contained in a gaseous system remains constant.

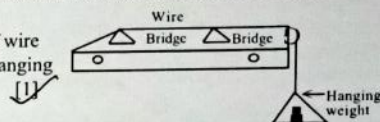
✓ Adiabatic curve is much steeper than an isothermal curve, why? [1]

✓ Derive an expression for workdone by an ideal gas in an adiabatic process. [2]

✗ A refrigerator has a coefficient of performance of 1.95. In each cycle, it absorbs  $3 \times 10^4 \text{ J}$  of heat from cold reservoir. How much heat is discarded to the high temperature during each cycle? [2]

15. Given figure represents the sonometer wire under certain tension T.

a) Does the frequency of fundamental vibration of wire depend on the value of hanging weight? Justify.



b) What will be the value of fundamental frequency of vibration of the wire if the hanging weight is immersed in a liquid of upthrust U? [1]

c) Describe the different modes of vibration in a closed organ pipe. [3]

16. a) Define potential gradient. Express it in terms of specific resistance of the potentiometer wire. [2]

b) An unknown resistance  $R_x$  is connected in series with resistance  $10\Omega$ . This combination is connected to one of the gaps of a meter bridge, while another resistance  $R_y$  is connected to next gap. The balance point is obtained at 50cm. Now, when  $10\Omega$  resistance is removed, the balance point is 40cm. Find the value of  $R_x$ . [3]

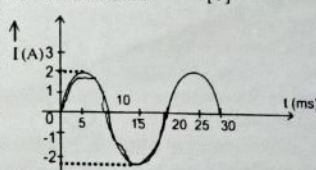
17. a) Observe the given graph and answer the following questions.

i) What is the value of the current I when time is 5ms? [1]

ii) What is the period T for the complete cycle? [1]

iii) What is the frequency of the given ac? [1]

b) Define peak value of an ac. How it is related to rms value of the ac? [2]

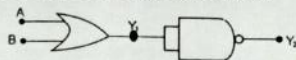


18. a) Define depletion layer and potential barrier in P-N junction diode? [2]

(3)

1021'D'

- b) For the digital circuit given below, write the truth table showing the outputs  $Y_1$  and  $Y_2$  for all possible inputs A and B. [2]



- c) Identify, which gate is obtained from the above combination of gates. [1]  
 19. a) Define ionization potential. [1]  
 b) The total energy of an electron in the first excited state of hydrogen atom is about -3.4 eV.  
 i) What is the potential energy of electron in this orbit? [1]  
 ii) If the electron in the first excited state jumps to the ground state of hydrogen atom then calculate the wave length of the emitted radiation. (Value of Rydberg's Constant,  $R = 1.097 \times 10^7 \text{ m}^{-1}$ ) [3]

Or

- ~~Radioactivity~~ is the property in which heavy elements undergoes spontaneous disintegrations.  
 i) Define decay constant. [1]  
 ii) What fraction of activity of a radioactive substance left after fourth half-lives?  
~~A G.M. counter~~ used to measure the activity of a radioactive element shows 895 counts per minute and after 10 minute, it shows 327 counts per-minute. Calculate decay constant and half life. [3]

Group 'C'

Long answer questions:

[3×8=24]

20. a) Sound waves are called pressure wave. Why? [1]  
 b) Define one bel. What is threshold of hearing? [2]  
 c) Derive an expression for apparent frequency heard by a listener while moving towards stationary source of sound. [2]  
 d) A car is approaching towards a cliff at a speed of 20m/s. The driver sounds a whistle of frequency 800Hz. Calculate the frequency of echo as heard by the car driver. [Velocity of sound in air 350m/s] [3]

Or

- ~~Does interference of light~~ follow the principle of conservation of energy? Justify. [1]  
~~Obtain the expression for the position of  $n^{\text{th}}$  order maxima from central bright fringe in Young's double slit experiment.~~ [2]

Contd...

(4)

1021'D'

- ~~How wide is the central diffraction peak~~ on a screen 3.5m behind a 0.01mm slit illuminated by 500nm light? [3]  
~~State and prove Brewster's Law.~~ [2]  
 21. a) i) Derive an expression for emf induced in a rectangular coil rotating in a uniform magnetic field. [3]  
 ii) Show the nature of induced emf graphically. [1]  
 b) What are eddy currents? [1]  
 c) A 50 cm long wire of mass 20gm is suspended horizontally in transverse magnetic field of flux density 0.6T through two springs at two ends. Calculate the current required to pass through the wire so that there is zero tension in the springs. [3]  
~~What is Seebeck effect?~~ [1]  
~~How does the thermo-emf produced in a thermo couple vary with the temperature of hot junction, when the cold junction is kept at  $0^\circ \text{C}$ ?~~ [2]  
~~Derive an expression for the magnetic field strength inside a long current carrying solenoid using Ampere's circuital law.~~ [3]  
~~An alpha particle of mass  $6.65 \times 10^{-27} \text{ kg}$  travels with a speed of  $6 \times 10^6 \text{ m/s}$  at right angle to the magnetic field of 0.2T. Calculate its acceleration.~~ [2]  
 22. In Thomson's Method, Specific charge of an electron is determined.  
 i) Why is electric field kept perpendicular to the magnetic field in this method? [1]  
 ii) What is the ratio of electric to the magnetic field? [1]  
 b) An electron moves in a circular path of radius 20 cm in a uniform magnetic field of  $2 \times 10^{-1} \text{ T}$ . Calculate the speed of electron and period of revolution. (Mass of electron =  $9.1 \times 10^{-31} \text{ kg}$ ) [3]  
 c) Sketch the graphs, showing the variation of stopping potential ( $V_0$ ) with the frequency of incident radiation for two photosensitive materials A and B having threshold frequency  $f_0$  and  $f_0'$  such that  $f_0 > f_0'$ . [1]  
 i) Which of two materials A or B has higher work function? [1]  
 ii) What does the value of intercept of graph A on the potential axis gives? [1]

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