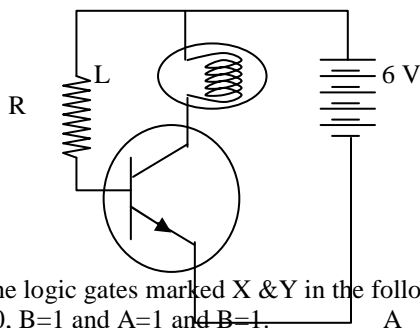# SAMPLE PAPER - 2007
CLASS XII
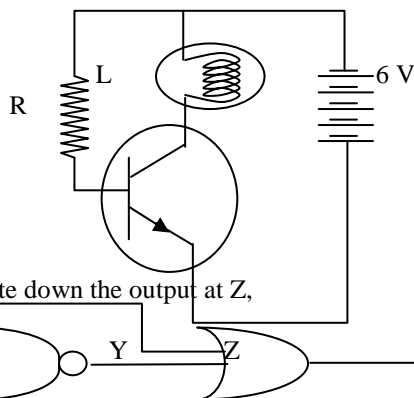# PHYSICS

Max marks: 70
Max time: 3 hrs.

General Instruction:
1. Answer all questions
2. Internal choices are provided for some questions
3. Question numbers 1 to 5 are very short answer questions and carry 1 mark each.
4. Question numbers 6 to 12 are short answer questions and carry 2 marks each.
5. Question numbers 13 to 24 are also short answer questions and carry 3 marks each.
6. Question numbers 25 to 27 are long answer questions and carry 5 marks each.
7. Use log tables if necessary.

1. Consider three charged bodies P,Q and R. If P and Q repel each other and P attracts R, what will be nature of the force between Q and R?
2. Why can't a transformer be used to step-up d.c voltage?
3. Among X-rays, infra-red rays, ultraviolet rays and visible radiations, which one has (i) highest frequency (ii) longest wavelength?
4. What is the de-Broglie wavelength of a 3kg object moving with a speed of 2 m/s?
5. Why should transmitters broadcasting programmes use different carrier frequencies?
6. An electron revolves around a proton in a H-atom at a speed of 2.18×10^6 m/s in an orbit radius $0.53A^0$. What magnetic field does it produce at the center of its circular orbit?
7. A short bar magnetic moment 0.9 JT^{-1} placed with its axis at 45^0 with a uniform external magnetic field experiences a torque of magnitude 0.063 J. Find the strength of the magnetic field.
8. State Faraday's law of electromagnetic induction. Express it mathematically.
9. Suppose that the electric field amplitude of an electromagnetic wave is $E_0=120$N/C and that it frequencies is 50 MHz (a) Determine B_0,ω and k (b)Find the expression for 'E'.
10. Two polaroids are placed at right angles to each other. What will happen to the intensity of transmitted light when one more polaroid is placed between these two bisecting the angle between them?
11. Two photons of energy 2.5eV each are incident simultaneously on a surface with work function 4.3eV will photoelectric emission take place? Justify.
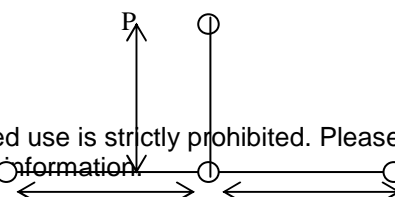12. In only one of the circuits given below the lamp L lights. Which circuit is it? Give reason for your answer?

(or)

Identify the logic gates marked X &Y in the following figure. Write down the output at Z, when A=0, B=1 and A=1 and B=1.
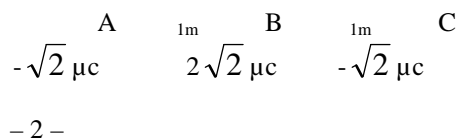

13. A conducting slab of thickness 't' is introduced without touching between the plates of a parallel plate capacitor, separated by a distance 'd'(t<d). Derive an expression for the capacitance of the capacitor.
14. Three charges - $\sqrt{2}$ μc, $2\sqrt{2}$ μc, - $\sqrt{2}$ μc are arranged along

a straight line as shown in the figure.
Calculate the total electric field intensity due to all the these   1m
three charges at the point P.

$$\begin{array}{ccccc}
A & \text{1m} & B & \text{1m} & C \\
-\sqrt{2}\ \mu c & & 2\sqrt{2}\ \mu c & & -\sqrt{2}\ \mu c
\end{array}$$

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15. AB is one metre long uniform wire of 10Ω resistance. $E_1 = 2V$
The other data are shown in the circuit diagram given. 15Ω
(i)Potential gradient along AB and   A   O   B   (ii)length AO of the wire,
when the galvanometer $1.2\ \Omega$ $E_2 = 1.5V$
shows no deflection.
                    G
                    (or) 0.3Ω A silver
and copper voltameter are connected in series with a 12V battery of negligible internal resistance
0.806g of silver is deposited in half an hour in the silver voltameter. Calculate (i)magnitude of current flowing
in the circuit. (ii)mass of copper deposited in the copper voltameter during the same period.
Given E.C.E of silver $= 1.12 \times 10^{-8}$ kg/C. Given E.C.E of copper $= 6.6 \times 10^{-7}$ kg/C.

16. A circular coil of 20 turns and radius 10cm is placed in a uniform magnetic field of 0.10 T normal to the plane of the coil. If the
current in the coil is 5.0A, what is the (a)total torque on the coil, (b)total force on the coil (c)average force on electron in the coil due
to the magnetic field?   (The coil is made of copper wire of cross-sectional area
10^{-5} m^2 and the free electron density in copper is given to be about $10^{29} m^{-3}$)

17. A person with a normal near point(25cm) using a compound microscope with objective of focal length 8.0mm and an eye-piece of
focal length 25cm can bring an object placed 9.0mm from the objective in sharp focus. What is the separation between the two lenses?
How much is the magnifying power of the microscope?

18. What is photo electric effect? Explain the effect of increase of (i)frequency (ii)intensity of radiation on photo electrons emitted by a
photo tube.

19. Derive the relation $N_t = N_0 e^{-\lambda t}$ for radio active decay. Obtain the relation between disintegration constant and half-life.

20. The neutron separation energy is defined as the energy required to remove a neutron from the nucleus. Obtain the neutron separation
energy of the nucleus $_{20}Ca^{41}$ from the following data? $M_n = 1.008665u$, $m(_{20}Ca^{40}) =$
$39.962591u$ & $m(_{20}Ca^{41}) = 40.962278u$.

21. Draw the energy band diagram of n-type semiconductor. The number of silicon atoms per m^3 is 5×10^{28}. This is doped simultaneously
with 5×10^{22} atoms per m^3 of Arsenic(pentavalent) and 5×10^{20} per m^3 atoms of Indium(trivalent). Calculate the number of electrons and
holes. Given that $n_i = 1.5 \times 10^{22}$.   Is the material n-type or p-type?

22. Draw a circuit diagram of a common-emitter amplifier using a n-p-n transistor. Prove that in this amplifier, the output voltage is 180^0
out of phase with the input voltage.

23. What is amplitude modulation? Discuss its advantage and disadvantage.

24. The core of an optical fibre is made of glass with refractive index equal to 1.55 and clad has refractive index 1.51. Calculate (a)The
critical angle for total internal reflection and (b)maximum acceptance angle at the air-core interference.

25. (a)Derive the relation $R = \dfrac{ml}{ne^2 A\tau}$, where symbols have their usual meanings.   (b)Two heater
are marked 200V,300W and 200V,600W. If the heaters are combined in series and the combination connected to a 200Vd.c. supply,
which heater will produce more heat?

26. Distinguish between the terms reactance and impedance from an a.c. circuit. A variable frequency 230V alternating voltage source is
connected across a series combination of L = 5H, C = 80μF and R = 40Ω. Calculate (i)the angular frequency of source which drives
the circuit in resonance (ii)amplitude of the current at resonating frequency (iii) r.m.s potential drop across the inductor at resonating
frequency.   (or)

Describe the construction, principle and working of a transformer. Why is a core of a transformer laminated?

27. A beam of light consisting of two wavelengths $6500A^0$ and $5200A^0$ is used to obtain interference fringes in Young's double slit experiment. The distance between the slits is 2mm and distance the plane of the slits and the screen is 120cm. (a)Find the distance of 3rd bright fringe on the screen from the central maximum for the wavelength $6500A^0$. (b)what is the least distance from central maximum, when the bright fringes due to both the wavelengths coincide?