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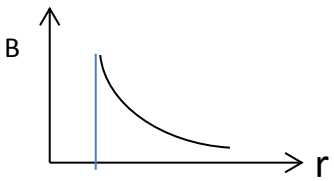
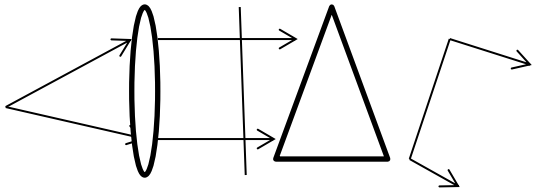
ERNAKULAM REGION

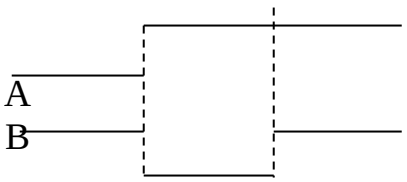
SAMPLE QUESTION PAPER-01

PHYSICS (042) 2012-13

ANSWER KEY

1.	At point A, the field strength 'E' is minimum, hence electric force experienced by the charge F = q E is minimum at A	**1**
2	Modulation index $\mu \leq 1$to avoid distortion.	**1**
3	Drift velocity $v_d = I/neA$ $v_d' = 2I/ ne \pi (2r)^2$, correct answer $v_d' = v_d /2$	½ ½
4	$B = \mu_0 I/ 2\pi r$, $B \alpha 1/r$. 	**Correct axes ½ , Shape of the graph ½.**
5	Advantage: Line loss is low Disadvantage: High voltage is dangerous.	**½ + ½**
6	$R = \rho l/A$, $A = \pi D^2$ Hence $R \alpha 1/D^2$	**1**
7	(i) For effective transmission and reception, the height of the antenna must be at least $\lambda/4$ in dimension. $H = \lambda/4 = (1/4)(c/\gamma)$ which is of the order of seveal Kilometers. (ii) Power radiated by the antenna will be very less as $P = (l/\lambda)^2$	½ ½
8	The ratio of refractive index of glass to the medium should be less than one.	**1**
9	$H = nI = 1000 \times 2 = 2000$ A/m $B = \mu_r \mu_0 H = 400 \times 4\pi \times 10^{-7} \times 2 \times 10^3 = 1.0$ T	**1** **1**
10	Diamagnetic, The phenomenon of perfect diamagnetism in superconductors is called Meissner effect.	**1** **1**

<table>
<tr><td>11</td><td>Minimum resistance $1/R_p = 3\ (1/r)$
Maximum resistance $R_s = 3\ r$
$R_p / R_s = (r/3)/3r = 1/9$</td><td>½
½
1</td></tr>
<tr><td>12</td><td>In case of rectangular loop, emf induced is constant.
In case of circular loop, the area associated with the magnetic field varies, emf indced also varies accordingly..</td><td>1
1</td></tr>
<tr><td>13</td><td>  </td><td>1 for each correct wave-front</td></tr>
<tr><td>14</td><td>Energy of one photon $E = h\nu = 3.3 \times 10^{-19}$ J
E1 = energy emitted by the source in one second = 66J
number of photons emitted by the source in 1s = $n = 2 \times 10^{20}$
Total number of photons emitted by source in 10 seconds
$= N = n \times 10 = 2 \times 10^{20} \times 10 = 2 \times 10^{21}$ photons</td><td>½
½

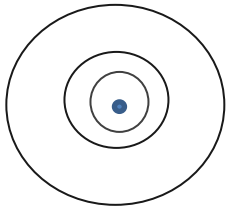
1</td></tr>
<tr><td>15</td><td>Truth table
<table>
<tr><th>A</th><th>B</th><th>-------
Y =(A +B)</th></tr>
<tr><td>0</td><td>1</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>0</td></tr>
</table>
Hence input wave form may be 

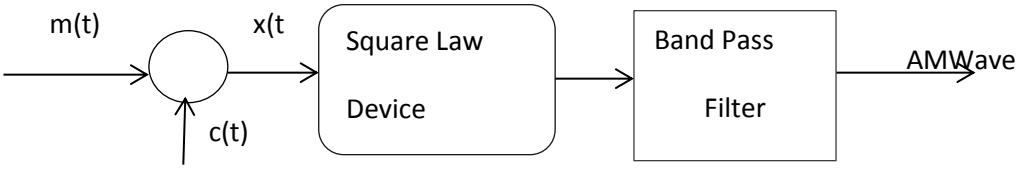
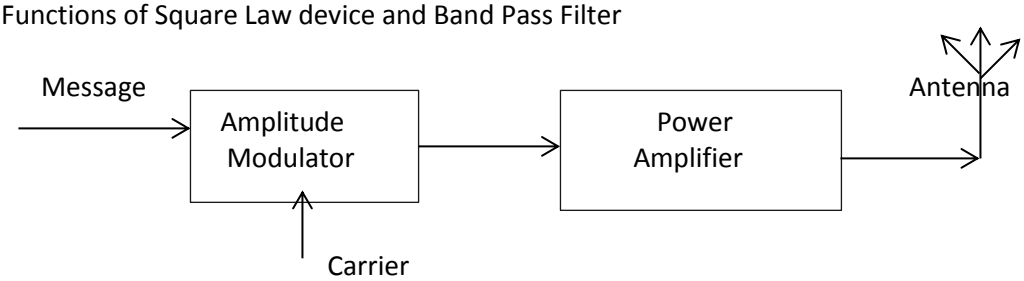
Or any different order.

The ‘or’ question
Truth table of the OR gate
Logic symbol, Boolean expression</td><td>1

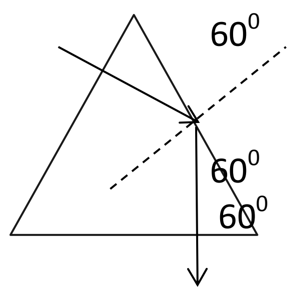
½ each

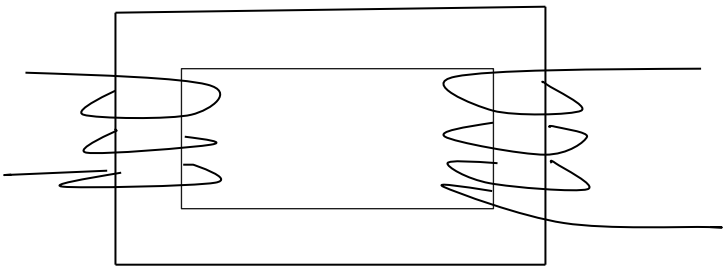
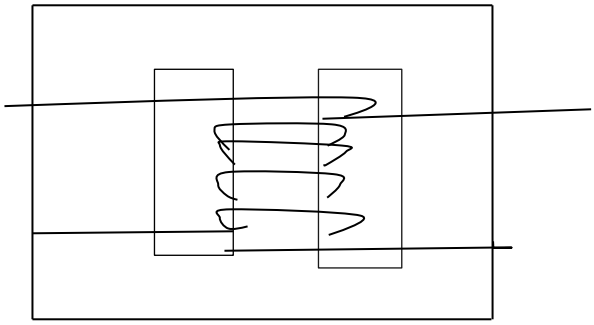
1
½ each</td></tr>
<tr><td>16</td><td>$\lambda = h/(\sqrt{2mqV})$
Slope of the straight line is $h/(\sqrt{2mq}) \ \alpha \ 1/\sqrt{m}$, Slope of the line B is large. So, B has smaller mass.
Or any other relevant answer.</td><td>½
½
1</td></tr>
</table>

17	Equipotential surfaces around a point charge are spherical in nature. Electric field is more near to the nucleus than far away.  At the two plane end faces electic flux is zero. At all points of the curved surface, Electric field is constant OR Definition of 1 Farad Initial Capacitance $C = \epsilon_0 A/d$ New capacitance $C' = \epsilon_0 (A/2)/d + k\epsilon_0 (A/2)/d$ $=(\epsilon_0 A/2d)(1+k)$ $= (40/2)(19+1) = 400\ \mu F$ (Correct answer & unit)	**1** **1** **1** **1** **1** **1**
18	Statement of the Principle of Potentiometer. Current I =2/(995 + 5) = 2 mA Potential drop across the wire PQ = $2 \times 10^{-3} \times 5 = 0.01$ V Potential gradient k =V/l = 0.01 V/m Emf generated by the thermocouple =0.01 x 0.4 = 0.004 V	**1** ½ ½ ½ ½
19	(i)For an electron, the lorentz force would be along the –z axis. (ii) Charged particle produces circular motionperpendicular to the magnetic field. (iii) The charged particle moves along the helical path as velocity of the particle has a component along the magnetic field.	**1** **1** **1**
20	Microwaves. $I_D = C\ dV/dt$, $dV/dt = 10^{-3}/(2 \times 10^{-6}) 5 \times 10^2$ V/s (correct formula,solution, answer, unit ½ each)	**1** **2**
21	Diffraction of light is highly pronounced if the size of the obstacle is of the order of wavelength of the light used Let d and d' be the width of the slits in the two cases. $\theta = \lambda/d$ and $q\theta = p\lambda / d'$ $d/d' = q/p$	**1** **½ , ½**

	Yes, this ratio would also equal q	½ ½
22	Diagram with proper labelling Derivation Wavelength in the medium $\lambda' = \lambda/\mu$ hence $\beta' = \beta/\mu$	½ **1** ½ **1**
23	Potential energy $U = -KZe^2/r$ Kinetic energy $K = \frac{1}{2} mv^2 = KZe^2/2r$ Total Energy $E = U + K = -KZe^2/2r$ (where $K = 1/4\pi\epsilon_0$ and $Z = 1$) Substituting the value of 'r', $E = -Rhc/n^2 = -13.6/n^2$ where R is the Rydberg constant. No, Electrons having different energies havedifferent values of 'n'. Hence the angular momentum $mvr = nh/2\pi$ will be different	½ ½ **1** **1**
24	$_{92}U^{238} \rightarrow {}_{90}Th^{234} + {}_{2}He^{4} + Q_1$ $Q_1 = (M_U - M_{Th} - M_{He})\, c^2$ or $= (M_U - M_{Th} - M_{He})\,(931.5)$ MeV $= 0.00456 \times 931.5$ MeV $= 4.25$ MeV $_{92}U^{238} \rightarrow {}_{91}Pa^{237} + {}_{1}H^{1} + Q_2$ $Q_2 = (M_U - M_{Pa} - M_H) \times 931.5$ MeV $= -7.68$MeV The Q_2 of the process is negative and therefore $_{92}U^{238}$cannot spontaneously emit a proton.	**1** **1** **1**
25	 Functions of Square Law device and Band Pass Filter 	**1** **½ each** **1**

26	Awareness of natural disaster and facing with courage. Empathy to people and society, Concern to the needy persons, Presence of mind and ability to solve the problems. Lightning conductor works on the principle of corona discharge (charge accumulation and discharging action of sharp points). According to Gauss's theorem, þE.dS = q/€0 Inside the cavity there are no charges. Hence Electric field is zero. Or any other relevant answer.	
27	For photoexcitation, $h\nu > E_g$ .Semiconductor with band gap ~ 1.5 eV or lower is likely to give better solar conversion efficiency. Or GaAs has relatively higher absorption coefficient. The V-I characteristics of Zener diode Diagram of zener as voltage regulator, working $I = I_0 \exp \{ (eV/2K_B T)-1 \}$ Given V =0.6 V, T = 300K, $I_0 = 5 \times 10^{-12}$A On substitution, $I = 2.07 \times 10^{-7}$ A Dynamic resistance $R = \delta v/\delta I = (0.7 - 0.6)/ (1.223 \times 10^{-6}) = 81.7$ kΩ OR (a) Transconductance is the ratio of small change in collector current to small change in base-emitter voltage. (b) Transistor as feed backoscillator- circuit diagram, Collector and emitter current variation graph due to inductive coupling (c) Voltage gain of the first amplifier $G_1 = 10$ Voltage gain of second one $G_2 = 20$. Input signal voltage $V_i = 0.01$V	**1** **1** **½ each** **1** **1** **1** **1 ½** **½** **2**

	$V_0 / V_i = G_1 G_2$ output voltage of the ac signal $V_0 = 2$ V	
28	Ray diagram of astronomical telescope in normal adjustment. (a) $1/f = 1v - 1/u$, $= -1/80$, focal length of concave lens is -80 cm Power $P = 1/f$, $= -1.25$ D (b) The concave lens brings image of the object at far point of the eyewhich is then focussed by the eyelens on the retina. (c) The angular size of the image of the book aat greater distance is clearly less than that when the book is placed at 25 cm or The person have a normal near point vision or any other relevant answer OR (a)  (b) For glass-air interface, $\sin i_c = 1/ {}_g\mu^a$, For glass-water interface, $\sin i_{c'} = 1/ {}_g\mu^w$, ${}_g\mu^w < {}_g\mu^a$, hence $\sin i_{c'} > \sin i_c$ (c) $\delta_V > \delta_R$, Angle of minimum deviation decreases.	**2** **½ + ½** **1** **1** **2** **1 + 1** **1**

29	(a) Maximum emf induced $£_0 = NBA\omega$ When ω is doubled, (a) frequency of AC will be doubled (b) emf gets doubled.	**1+1**
	(b) Diagram	**½**
	Derivation	**1 ½**
	(c) The person is carrying anything made of metal. Principle of resonance in A C circuits.	**½ , ½**
	OR	
		**½ + ½**
		
	Ratio $V_s / V_p = N_s / N_p$	**1**
	High permeability, narrow hysteresis loop	**½ each**
	Any four energy losses	**½ each**