Arc | AIEEE

AIEEE
Mock Test – I
Answers and Explanations

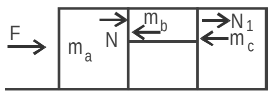
Physics			
1	a	**21**	c
2	d	**22**	a
3	a	**23**	c
4	b	**24**	a
5	b	**25**	b
6	b	**26**	b
7	a	**27**	d
8	c	**28**	a
9	b	**29**	b
10	c	**30**	c
11	a	**31**	b
12	c	**32**	a
13	a	**33**	a
14	b	**34**	a
15	c	**35**	a
16	d		
17	b		
18	a		
19	a		
20	d		

Physics

1. a This is a parallel combination of springs.

$\therefore\ k_{eq} = k_1 + k_2 + k_3 + k_4$

2. d



$$A = \frac{F}{m_a + m_b + m_c}$$

$F - N = m_a A$

$N_1 = m_c A$

$$= \frac{m_c F}{m_a + m_b + m_c}$$

$\mu N_1 = m_b g$

$$\Rightarrow \frac{\mu m_c F}{m_a + m_b + m_c} = m_b g$$

$$F = \frac{m_b(m_a + m_b + m_c)g}{\mu m_c}$$

3. a $T = 2\pi\sqrt{\frac{I}{C}}$

$$= 2\pi\sqrt{\frac{Mr^2}{C}}$$

$$= \left(2\pi\sqrt{\frac{M}{C}}\right)r$$

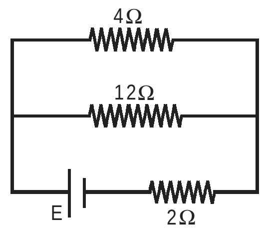
$T \propto r$

4. b $W = \vec{F}.\vec{d} = (5\hat{i} + 3\hat{j} + 2\hat{k}).(2\hat{i} - \hat{j}) = 10 - 3 = 7$ J

5. b $\log_e(\theta - \theta_\circ) = -kt + c$

6. b During adiabatic process, $\Delta u = \Delta Q - \Delta W = -\Delta W$. Hence, if $\Delta u = -80$ J (decrease), then $\Delta W = +80$ J (work done by gas).

7. a **Equivalent Circuit Diagram**



$E = BVl$

$$= (0.5)(4)\left(\frac{1}{4}\right)$$

$$E = \frac{1}{2}V$$

$$Req = \frac{4 \times 12}{4 + 12} + 2 = 5$$

$$i = \frac{E}{Req}$$

$$= \frac{0.5}{5}$$

$i = 0.1$

8. c From Newton's formula

$$\eta = \frac{F}{A(\Delta v_x / \Delta z)}$$

$\therefore$ Dimensions of

$$\eta = \frac{\text{dimensions of force}}{\text{dimensions of area} \times \text{dimensions of velocity} - \text{gradient}}$$

$$= \frac{[MLT^{-2}]}{[L^2][T^{-1}]} = [ML^{-1}T^{-1}]$$

9. b The third equation of motion is $v^2 = u^2 + 2as$

Here v = 0, u = v and a = $-\mu g$

So $0 = v^2 + 2(-\mu g)s$

or $s = \frac{v^2}{2\mu g}$

10. c $B_1 = \frac{\mu_0}{4\pi}\left(\frac{2\pi i_1}{r_1}\right)$

$B_2 = \frac{\mu_0}{4\pi}\left(\frac{2\pi i_2}{r_2}\right)$

Since $r_2 = 2r_1$, $B_1 = B_2 \Rightarrow i_2 = 2i_1$

$\frac{V_q}{V_p} = \frac{i_2 \times r_2}{i_1 \times r_1} = \frac{2i_1}{i_1} \times \frac{2r_1}{r_1} = 4$

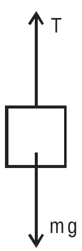
or $V_q = 4V_p$

11. a $\frac{f}{2} = \frac{v}{v + v_s} \Rightarrow \frac{1}{2} = \frac{330}{330 + v_s} \Rightarrow v_s = 330\ m/s$

12. c Since the block is not sliding,
Force of friction in upward direction along the inclined plane = $mgSin\theta$
displacement in vertical upward direction = vt

$\therefore W = mgSin\theta.vt.Cos(90-\theta) = mgvtSin^2\theta$

13. a



$T_u - Mg = Ma$
$Mg - T_D = Ma$
$T_u - T_D = 2\ Ma$
$= 2 \times 0.1 \times 5\ N = 1\ N$

14. b $v = \sqrt{gR} = \sqrt{9.8 \times 6.4 \times 10^6}$

$= 7.9 \times 10^3\ ms^{-1} \approx 8 \times 10^3 km/s$

15. c We know in advance that range of projectile is same for complementary angles i.e. for θ and $(90^\circ - \theta)$.

$\therefore T_1 = \frac{2u\sin\theta}{g}$

$T_2 = \frac{2u\sin(90^\circ - \theta)}{g} = \frac{2u\cos\theta}{g}$

and $R = \frac{u^2 \sin 2\theta}{g}$

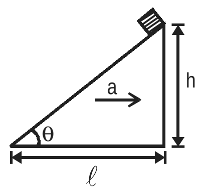
Therefore, $T_1T_2 = \frac{2u\sin\theta}{g} \times \frac{2u\cos\theta}{g}$

$= \frac{2u^2(2\sin\theta\cos\theta)}{g^2}$

$= \frac{2u^2(\sin 2\theta)}{g^2} = \frac{2R}{g}$

$\therefore T_1T_2 \propto R$

16. d



$h = \frac{1}{2}gt^2$ ... (i)

$\ell = \frac{1}{2}at^2$ ... (ii)

From (i) and (ii), $\frac{\ell}{h} = \frac{a}{g}$

But $\frac{\ell}{h} = \cot\theta$

Then, a = $g\cot\theta$

17. b $H = K\left(\frac{\pi d_1^2}{4}\right)\left(\frac{T_1 - T_2}{5}\right) = \frac{K\left(\frac{\pi d_2^2}{4}\right)}{L_2}(T_1 - T_2)$

$\Rightarrow \frac{d_1^2}{L_1} = \frac{d_2^2}{L_2} \Rightarrow \frac{L_1}{L_2} = \left(\frac{d_1}{d_2}\right)^2$

18. a $\frac{1}{C_1} = \frac{1}{1} + \frac{1}{1} + \frac{1}{1} = 3$; $\frac{1}{C_2} = \frac{1}{3}$

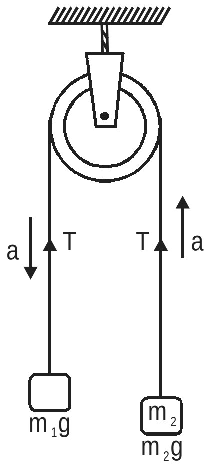
Capacitance between A and B is

$C_p = \frac{1}{3} + 1 = \frac{4}{3}\mu F$

19. a On releasing, the motion of the system will be according to the figure.

$m_1g - T = m_1a$ ....(i)

and $T - m_2g = m_2a$ ....(ii)



On solving; $a = \left(\frac{m_1 - m_2}{m_1 + m_2}\right)g$ ....(iii)

Here,

$m_1 = 5$ kg, $m_2 = 4.8$ kg, $g = 9.8$ m/s^2

$\therefore a = \left(\frac{5 - 4.8}{5 + 4.8}\right) \times 9.8$

$= \frac{0.2}{9.8} \times 9.8 = 0.2\ m/s^2$

20. d According to triangle law of forces, the resultant force is zero.

In presence of zero external force, there is no change in velocity

21. c Factual

22. a $y = 10^{-4} \text{Sin}(600t - 2\times + \pi/3)$

$v = \frac{\omega}{k} = \frac{600}{2} = 300\ m/s$

23. c Electric field at the centre E = $\frac{\sigma}{2\pi R\varepsilon_0}$

$\therefore$ Force exerted on the charge = Eq

$\therefore$ The instantaneous acceleration = $\frac{\sigma q}{2\pi m R\varepsilon_0}$

24. a Peltier coefficient is

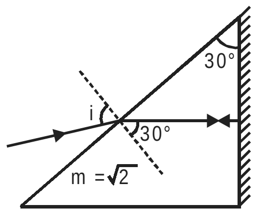
$\pi = \frac{TdE}{dT}$

$= T \times S$ or $S = \frac{\pi}{T}$

25. b No. of α particles emitted = 8, No of β^- particles emitted = 4, No of β^+ particles emitted = 2

z = 92 – 2 × 8 + 4 – 2 = 78

26. b



$\sin i = \sqrt{2} \sin r$

$\sin i = \sqrt{2} \times \frac{1}{2}$

i = 45°

27. d Let the temperature of common inner slab (surface) is T° C.

In steady state, the rate of heat flow should be same in whole system, i.e.

$H_1 = H_2$

$\Rightarrow \frac{2KA(T - T_1)}{4x} = \frac{KA(T_2 - T)}{x} \quad \Rightarrow \frac{T_1 + 2T_2}{3}$

Hence, the heat flow from composite slab is

$= \frac{KA}{x}\left(T_2 - \frac{2T_2 + T_1}{3}\right) = \frac{KA}{3x}(T_2 - T_1)$ ... (ii)

Hence, $\left[\frac{A(T_2 - T_1)}{x}K\right]f = \frac{KA}{3x}(T_2 - T_1)$

$\Rightarrow f = \frac{1}{3}$

28.a Volume of water above the free surface

$= \pi r^2\left(h + \frac{r}{3}\right)$

Weight $= \pi r^2\left(h + \frac{r}{3}\right)\rho g$

29. b

30. c

31. b $dF = BI_1\,dx$

$F = \int dF = \int_a^{2a} \frac{\mu_0 I_2}{2\pi x} I_1 dx$

$F = \frac{\mu_0 I_1 I_2}{2\pi} \ln 2$

32. a

33. a $\Delta m = (16.999 + 1.0078) - (14.003 + 4.002)$

$\Delta m = 0.0018$

$Q = \Delta m \times 931 = 1.675$

34. a

35. a [(1.0078 + 1.009) × – 4.002] × 931 = 29.42