TZ2

Summer 2017 IB Physics Paper 1 HL

1. $d = \frac{1}{2}at^2$

"negligible" $\swarrow$

$\frac{\Delta d}{d} = \frac{\Delta a}{a} + 2\frac{\Delta t}{t}$

$\frac{\Delta d}{20} = 0 + 2 \times \frac{0.2}{2}$

$\Delta d = 0.2 \times 20 = 4m$ D

6. $F = \frac{mv - mu}{t}$ (N2)

Area under graph $= \frac{1}{2} F_{max} (440 - 400) \times 10^{-3} \leftarrow ms = 0.2 \times 4$

$F_{max} = \frac{0.04}{10^{-3}} = 40N$

D

7. Explosion: $0 = m_\alpha v_\alpha + m_\ell v_\ell$

$v_\ell = \frac{m_\alpha v_\alpha}{m_\ell} = \frac{4v}{206}$ D

9. Kinetic energy $\propto$ absolute temperature
Temperature is constant throughout container so ratio not related to masses. Trick question! A

16. Kirchoff: current into a node = current out
$\therefore$ I constant
$I = nAve$ at X
$I = n(2A)\left(\frac{v}{2}\right)e$ at Y B

17. Magnetic field + charged particle → movement/force
Motor effect! ∴ FLHR
- Force (thumb) upwards / centre of circle
- Field (first) into page

⇒ Second finger right, same direction as arrow so conventional current shown.
Needs to be a positive charge A

21. Nuclear reaction (so change in mass) with energy released so mass ↓ ∴ $M_X + M_Y > M_Z + M_W$

Products more stable since energy released so binding energy ↑ ∴ $BE_X + BE_Y < BE_Z + BE_W$ C

24. Rate of radiation loss ∝ $\Delta(T^4)$

$\therefore P \propto 400^4 - 300^4$ ①

and $P_{500} \propto 500^4 - 3\cancel{4}00^4$ ②

$$\frac{②}{①} \quad \frac{P_{500}}{P} = \frac{500^4 - 3\cancel{4}00^4}{400^4 - 300^4}$$

$$\div 100^4 \quad P_{500} = \frac{5^4 - 3^4}{4^4 - 3^4} P$$

D

26. $E_K = \frac{1}{2} m\omega^2 (x_0^2 - x^2)$

$$\frac{E_K}{16} = \frac{x_0^2 - \left(\frac{x_0}{2}\right)^2}{x_0^2} \quad \leftarrow E_T$$

$$= \frac{1 - \frac{1}{4}}{1}$$

$E_K = 12J$ C

27. $n\lambda = d\sin\theta$ (clue: angular positions)
If $\lambda \uparrow$ (blue to red), $d \uparrow$

Ⓓ

28. Using $\theta = 1.22\frac{\lambda}{b}$, objects will be resolved

for any $\theta \geq 1.22\frac{\lambda}{b}$ ⇒ reduce λ and increase b

Ⓒ

31. work done $= \Delta E_p = m\Delta V_g$

$= m$ [area between $V_1 \rightarrow 0$ and $V_2 \rightarrow 0$]

NB: scalar so just looking for area

$= m(V_1 - 0 - (V_2 - 0))$

$= m(V_1 - V_2)$

Ⓑ

33. Lenz Law: system will try to reduce the change of flux, so ring will move 'with' the magnet (to reduce relative motion).
If magnet ←, ring ← and → →

Ⓑ

38. $v_{orbit} \propto \sqrt{\frac{1}{r}}$

$v_{excited} \propto \sqrt{\frac{1}{4r}}$

$\frac{v_{excited}}{v_{orbit}} = \frac{\sqrt{\frac{1}{4r}}}{\sqrt{\frac{1}{r}}} = \frac{1}{2}$

Ⓐ

39. $\Delta x \Delta p \geq \frac{h}{4\pi}$

minimum $p \approx 0$

$\Delta p \approx \frac{h}{4\pi \Delta x} \approx \frac{h}{4\pi d}$ since $p \approx p_0 + \Delta p$

Now, $E_K = \frac{p^2}{2m} \approx \frac{\Delta p^2}{2m} = \frac{h^2}{8\pi^2 m d^2}$

"Ignoring numerical constants" $\Rightarrow E_K \approx \frac{h^2}{md^2}$ A

40. $N_t = Ne^{-\lambda t}$ Number remaining at time t

Number decayed $= N - N_t$

$= N - Ne^{-\lambda t}$

$= N(1 - e^{-\lambda t})$

Since $t = 1s$, $N(1-e^{-\lambda})$ A

2. B
3. D
4. C
5. B
8. C
10. B
11. D
12. B
13. A
14. C
15. B
18. D
19. A
20. C
22. B
23. A
25. D
29. D
30. B
32. C
34. A
35. C
36. A
37. C