المدة: ساعتان	سلم تصحيح مقرر اللغة الأجنبية العلمية	جامعة دمشق
13.30 - 11.30	السنة الرابعة فيزياء (1)	كلية العلوم
الدرجة:100/ مئة	الفصل الأول، العام الدراسي 2024 - 2025/	قسم الفيزياء

Part I (50 Marks)

1 Mark for each ques

Q1. Read carefully and choose the right answer of the following: (10 Marks)

1. steel (D)	2. the temperature remains the same (C)
3. radiation will provide quick warmth (B)	4. of slightly different frequencies (B)
5. of same frequencies (B)	6. heat of fusion (A)
7. energy transferred by a temperature difference (A)	8. 60 dB (E)
9. 20 to 20,000 HZ (C)	10. Radiation (C)

Q2. (20 Marks)

Solution:

(a) The positive direction is from a U.S. submarine toward the a French submarine (listener to source). (2)

In this situation, $v_F = v_S = -50$ km/h and $v_{US} = v_L = 70$ km/h
$v = 5470$ km/h and $f_S = 1000$ Hz (4)

$$\text{Apply } f_L = \left(\frac{v + v_L}{v + v_S}\right) f_S. \quad (2)$$

$$f_L = \frac{5470 + 70.00}{5470 - 50.00}(1000) = 1.002 \times 10^3 \text{ Hz} \quad (3)$$

(b) The positive direction is from a French submarine toward the a U.S. submarine (listener to source). (2)

In this situation, $v_F = v_L = 50$ km/h and $v_{US} = v_S = -70$ km/h
$v = 5470$ km/h and $f_S = 1022$ Hz (4)

$$\text{Apply } f_L = \left(\frac{v + v_L}{v + v_S}\right) f_S.$$

$$f_L = \frac{5470 + 50.00}{5470 - 70.00}(1022) = 1.045 \times 10^3 \text{ Hz} \quad (3)$$

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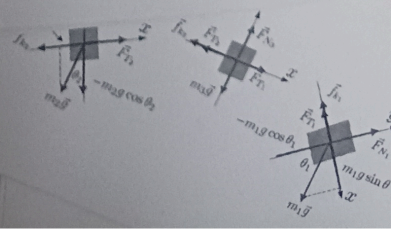

Q3. [illegible] سنة رابعة

2

(20 Marks)

Solution:

Must be added to do the following:

Ice at $-10.0^{\circ}C \rightarrow$ ice at $0^{\circ}C$:

$Q_{ice} = mc_{ice}\Delta T = (12.0\times10^{-3}\ \text{kg})(2100\ \text{J/kg.K})(0^{\circ}C-(-10.0^{\circ}C)) = 252\ \text{J}$ (4)

Phase transition ice ($0^{o}C$) $\rightarrow$ liquid water ($0^{o}C$) (melting)

$Q_{melt} = +mL_f = (12.0\times10^{-3}\ \text{kg})(334\times10^{3}\ \text{J/kg}) = 4.008\times10^{3}\ \text{J}$ (4)

Water at ($0^{o}C$) (from melted ice$\rightarrow$ water at $100^{o}C$)

$Q_{water} = mc_{water}\Delta T = (12.0\times10^{-3}\ \text{kg})(4190\ \text{J/kg.K})(100^{\circ}C-0^{\circ}C) = 5.028\times10^{3}\ \text{J}$ (3)

Phase transition water ($100^{o}C$) $\rightarrow$ steam ($100^{o}C$) (boiling)

$Q_{boil} = +mL_v = (12.0\times10^{-3}\ \text{kg})(2256\times10^{3}\ \text{J/kg}) = 2.707\times10^{4}\ \text{J}$ (2)

The total Q is:

$Q_{total} = 252\ \text{J}+4.008\times10^{3}\ \text{J}+5.028\times10^{3}\ \text{J}+2.707\times10^{4}\ \text{J}=3.64\times10^{4}\ \text{J}$ (3)

Converting joules to calories:

$(3.64\times10^{4}\ \text{J})(1\ \text{cal}/4.186\ \text{J})=8.70\times10^{3}\text{cal}$ (3)

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2025/02/10

مدرس المقرر

د. يوسف ابوعلي

لغة أجنبية علمية متقدمة (3)

Part II: Dr.rer.nat. Ali Al-Khatib (Elemintary Particle Physics and Cosmology) Correction Scale (50 points)

QI- MCQ: Copy the following table to your answer sheet and fill it with your choice for each question (28=22+6) pts

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
c	b	d	a	e	a	d	a	e	c	d	b	d	d	e	a	b	e	a	e	c	d	e	c	b

QII- Solve the following prolblems (22 = 14 + 8 pts)

1- A stationary positive pion can decay according to $\pi^+ \to \mu^+ + \nu_\mu$. Calculate the kinetic energy, $\mathcal{K}_\mu$, of the antimuon and, $\mathcal{K}_\nu$, of the neutrino. $(m_{\pi^+} = 139.6\,\mathrm{MeV/c^2}, m_\nu \approx 0, m_{\mu^+} = 105.7\,\mathrm{MeV/c^2})$

Solution [14]

Energy conservation: $m_\pi c^2 + \mathcal{K}_\pi = m_\mu c^2 + \mathcal{K}_\mu + m_\nu c^2 + \mathcal{K}_\nu$ [2]

stationary pion $\Rightarrow \mathcal{K}_{pi} = 0 \Rightarrow \mathcal{K}_\mu + \mathcal{K}_\nu = 139.6\,\mathrm{MeV} - 105.7\,\mathrm{MeV} - 0 = 33.9\,\mathrm{MeV}$ [2]

Momentum conservation: $p_\pi = p_\mu + p_\nu, \quad p_\pi = 0 \Rightarrow p_\mu = -p_\nu$ [2]

momentum-kinetic energy conservation from special relativity: $P^2c^2 = \mathcal{K}^2 + 2\mathcal{K}mc^2$ [2]

$(p_\mu c)^2 = (-p_\nu)^2 \Rightarrow \mathcal{K}_\mu^2 + 2\mathcal{K}_\mu m_\mu c^2 = \mathcal{K}_\nu^2 + 2\mathcal{K}_\nu m_\nu c^2$

$\mathcal{K}_\mu^2 + 2\mathcal{K}_\mu m_\mu c^2 = (33.9\,\mathrm{MeV} - \mathcal{K}_\mu)^2 + 0$ [2]

$\Rightarrow \mathcal{K}_\mu = \frac{(33.9\,\mathrm{MeV})^2}{2(33.9\,\mathrm{MeV} + m_\mu c^2)} = \frac{(33.9\,\mathrm{MeV})^2}{2(33.9\,\mathrm{MeV} + 105.7\,\mathrm{MeV/c^2 c^2})} \Rightarrow \boxed{\mathcal{K}_\mu = 4.12\,\mathrm{MeV}}$ [2] $\Rightarrow \boxed{\mathcal{K}_\nu = 29.8\,\mathrm{MeV}}$ [2]

2- **White dewarf (non-relativistic degenerate Fermi gas):**

The total energy of the white dewarf in non-relativistic approximation is given by:

$$E(r)_{nonrel} = -k_1 \frac{M_s^2}{r} + k_2 \frac{M_s^{5/3}}{r^2}$$

wher k_1, k_2 are constants, M_s and r are the mass and the radius of the white dewarf, respectively.

Prove that $\boxed{r_{eq} M^{1/3} = k}$ where r_{eq} is the equilibrium radius of the star and k is a constant.

Solution[8]

$\frac{dE(r)_{nonrel}}{dr} = 0 \Rightarrow k_1 \frac{M_s^2}{r_{eq}^2} - k_2 \frac{M_s^{5/3}}{r_{eq}^3} = 0$[4] $\Rightarrow r_{eq} = \frac{k_1}{k_2} \frac{M_s^{5/3}}{M_s^2} = kM_s^{-1/3}$[4] $\Rightarrow r_{eq} M_s^{1/3} = k$

Good Luck | The End | Dr.rer.nat. Ali Al-Khatib