Question	Unit	Answer	Level	SCO	Pg.#
1	1	D	1	325-5	24
2	1	A	2	325-5	24
3	1	D	1	325-2	26
4 lab	1	D	1	325-2	26
5	1	C	1	325-2	28
6	1	C	3	325-2	26
7	1	B	2	325-2	28
8	1	D	2	325-7	34
9	1	B	2	325-8	34
10	2	D	1	325-8	42
11	2	D	1	325-8	44
12	2	A	3	325-8	44
13	2	A	2	325-5	42
14	2	B	2	325-8	48
15	2	C	2	325-5	42
16 lab	2	C	2	325-8	44
17	2	B	2	325-8	46
18	2	D	1	326-3	52
19	2	C	1	326-3	52
20	2	C	2	326-3	52
21	3	A	2	325-9	58
22	3	B	2	325-10	58
23	3	C	2	326-1	60
24	3	D	1	326-1	60
25	3	B	1	326-1	62
26	3	C	1	327-4	62
27	3	A	2	326-1	62
28	3	D	3	326-1	66
29	3	B	2	326-8	68
30	4	B	1	212-7, 327-1	78
31	4	C	1	212-7, 327-1	78
32	4	C	1	212-7, 327-1	80

33	4	B	2	327-7, 327-8	84
34	4	D	3	327-7, 327-8	84
35	4	A	2	327-7, 327-8	84
36	4	D	2	327-2	80
37	4	C	2	327-5, 327-6, 327-7	88
38	4	A	2	212-7, 327-5, 327-6, 327-7	90
39 lab	4	B	2	327-5, 327-8	92
40	4	B	1	327-5, 327-8	92

Unit 1: Kinematics
Unit 2: Dynamics
Unit 3: Work and Energy
Unit 4: Waves

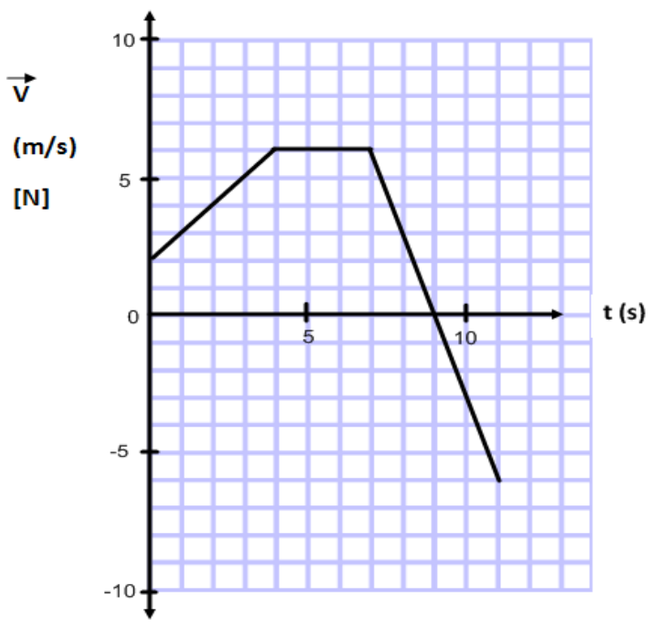
1: Knowledge/Comprehension
Level 2: Application
Analysis/Synthesis/Evaluation

PART II
Total Value: 40 marks

Answer **ALL** questions in the space provided. *Show all your workings.*

Value

41. (a) Use the graph to answer the questions below.



2 (i) Calculate the acceleration at 10 s.

$\vec{a}$ = slope = $\frac{\text{-6 - 6 m/s}}{\text{11 - 7s}}$ = -3.0 m/s

0.5 marks for recognizing a = slope

1 mark for calculation/answer

0.5 marks for - sign in answer

2 (ii) Calculate the displacement from 0 s to 4 s.

d = area = (l×w) + ($\frac{1}{2}$ bh) = (2 × 4) + ($\frac{1}{2}$ × 4 × 4) = 16 m

0.5 marks for recognizing d = area

0.5 marks for calculating each area (rectangle and triangle)

0.5 marks for correct answer

1 (iii) At what time is the object at rest?

Stopped at t = 9 s (v = 0 m/s)

0.5 marks for recognizing v = 0 when line crosses x-axis

0.5 marks for correct answer

1 (iv) During which time interval is the object travelling at a constant velocity?

Constant velocity from t = 4 - 7 s (Line is horizontal meaning a = 0)

0.5 marks for recognizing velocity is constant when graph is horizontal line

0.5 marks for correct answer

3 (b) A car is travelling at a constant velocity of 28 m/s when the driver sees a moose 75 m ahead. The brakes are then applied, causing the car to accelerate at – 6.4 m/s². What was the maximum reaction time the driver had to apply the brakes and avoid hitting the moose?

(Note: Space on the page has been left in the event you would like to include a diagram.)

Distance needed to stop:

$2\vec{a}\vec{d} = \vec{v}_2^{\,2} - \vec{v}_1^{\,2}$ (0.5 marks)

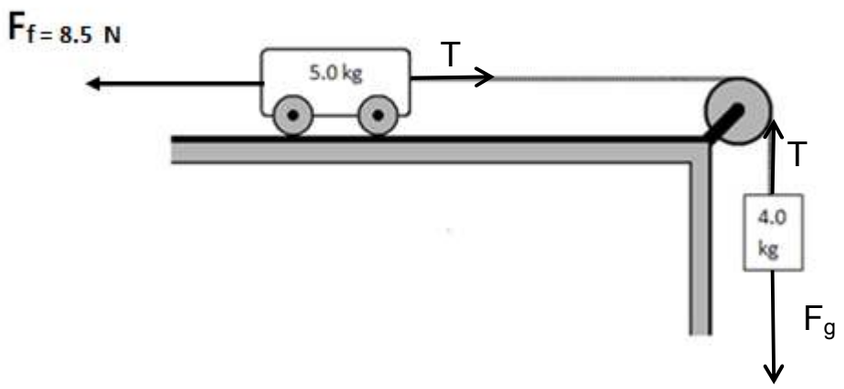
$d = \frac{0^2 - 28^2}{2(-6.4)} = 61.25 \text{ m}$ (1 mark)

Distance remaining for driver reaction:

$75 - 61.25 = 13.75 \text{ m}$ (0.5 marks)

$t = \frac{d}{v} = \frac{13.75}{28} = 0.49 \text{ s}$ (1 mark)

42. (a) Two masses are connected by a massless string over a frictionless pulley. There is a frictional force of 8.5 N acting on the 5.0 kg cart.



3 (i) Calculate the acceleration of the system when the 4.0kg mass is released.

System:

$\vec{F}_{NET} = \vec{F}_g + \vec{F}_f$ (1 mark)

$m_T\vec{a} = m_2\vec{g} + \vec{F}_f$ (0.5 marks for using total mass of system)

$(5.0 + 4.0)\vec{a} = (4.0)(9.80) + (-8.5)$ (0.5 marks)

$\vec{a} = \frac{30.7}{9.0} = 3.4 \text{ m/s}^2$ (1 mark)

2 (ii) Calculate the tension in the string when the 4.0kg mass is released.

Isolate the mass on the table:

$\vec{F}_{NET1} = \vec{T} + \vec{F}_f$ (0.5 marks)

$m_1\vec{a} = \vec{T} + \vec{F}_f$ (0.5 marks for correct mass)

$(5.0)(3.4) = \vec{T} + (-8.5)$ (0.5 marks)

$\vec{T} = 26 \text{ N}$ (0.5 marks)

3 (b) A 120 kg ATV moving at 15 m/s collides with a stationary 35 kg barbeque. If they stick together on impact, what is their common final velocity?

$\vec{p} = \vec{p}'$

$m_1\vec{v}_1 + m_2\vec{v}_2 = (m_1 + m_2)\vec{v}'_{12}$ (1 mark)

$(120)(15) + (35)(0) = (120 + 35)\vec{v}'_{12}$ (1 mark)

$1800 = 155\vec{v}'_{12}$

$\vec{v}'_{12} = \dfrac{1800}{155} = 12 \text{ m/s}$ (1 mark)

3 (c) In the "Wreckhouse" area, the winds can cause windows to break with gusts up to 180 km/h. Calculate the force on a window if 40.0 kg of air moving at 180 km/h strikes a window over a contact time of 0.20 s. Assume the air stops moving when it hits the glass.

$180 \text{ km/h} = 180 \div 3.6 = 50 \text{ m/s}$ (1 mark)

$\vec{F}t = m\Delta\vec{v}$ (0.5 marks)

$\vec{F}(0.20) = (40.0)(0 - 50)$ (0.5 marks)

$\vec{F} = -10000 = -1.0 \times 10^4 \text{ N}$ (1 mark)

3 43. (a) Using principles of Physics, explain which one of these Olympic weight lifters is doing the most work.

Lifter A raises a 50 kg mass 2m vertically from the floor.

Lifter B holds a 50 kg mass at shoulder height and walks 2m forward at a constant velocity.

Lifter A does more work. (1 mark)

This is because a force is applied to lift the mass and the mass moves in the direction of the applied force. (1 mark)

Lifter B actually does zero work because the mass does not move in the direction of the force or a component of the force. (1 mark)

3 (b) A spring (k = 125 N/m) is used to launch a 0.15 kg toy straight upwards from the ground. If the spring is compressed 0.080 m, what is the maximum height reached by the toy?

$E = E'$ (0.5 marks)

$E_e = E_g$ (0.5 marks)

$\frac{1}{2}kx^2 = mgh$

$\frac{1}{2}(125)(0.080)^2 = (0.15)(9.80)h$ (1 mark)

$0.4 = 1.47h$

$h = \frac{0.4}{1.47} = 0.27 \text{ m}$ (1 mark)

3 (c) A light bulb has a power input of 40 W and is only 4.0% efficient. What is the light energy output from the light bulb in a time of 3600s?

$P_{in} = \frac{W_{in}}{t}$ (0.5 marks)

$40 = \frac{W_{in}}{3600}$

$W_{in} = 144000 \text{ J}$ (0.5 marks)

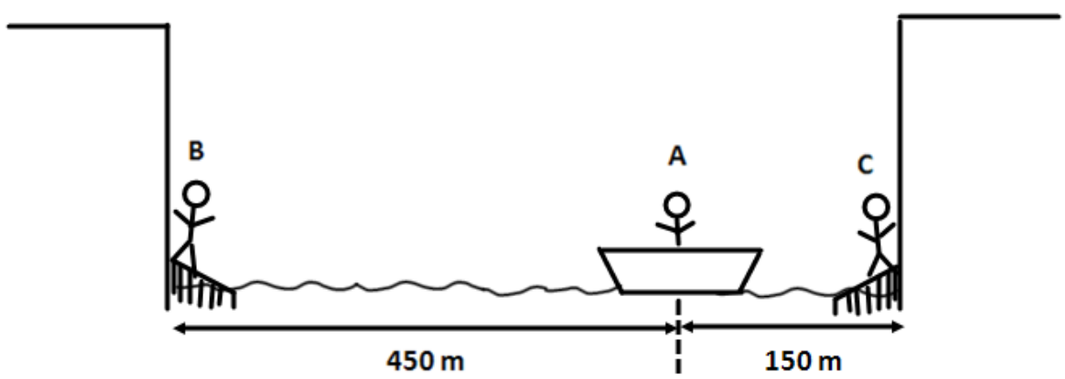
$\text{efficiency} = \frac{W_{out}}{W_{in}} \times 100\%$ (0.5 marks)

$4.0\% = \frac{W_{out}}{144000} \times 100\%$ (0.5 marks)

$0.040 = \frac{W_{out}}{144000}$

$W_{out} = 5760 = 5800 \text{ J}$ (1 mark)

44. (a) Use the diagram below to answer the questions.



2 (i) When person A calls for help, how long will it take her to hear the echo from the nearest cliff if the speed of sound is 338 m/s?

$d = 150 \times 2 = 300 \text{ m}$ (1 mark)

$t = \frac{d}{v} = \frac{300}{338} = 0.89 \text{ s}$ (1 mark)

(ii) B and C hear a call for help from A. By what factor does the intensity of the sound heard by B differ from the intensity of the sound heard by C?

Intensity $\alpha \frac{1}{r^2}$ (0.5 marks)

Person B is $\frac{450}{150} = 3$ times the distance of person C (0.5 marks)

$\frac{1}{3^2} = \frac{1}{9}$ (0.5 marks)

Person B hears the call for help with $\frac{1}{9}$ the intensity of person C. (0.5 marks)

(b) A student is planning to conduct an experiment to verify Snell's Law.

3 (i) As a pre-lab exercise, he attempted to calculate the angle of refraction in air (n = 1.00) using an angle of incidence in water (n = 1.33) of 52°. Determine if the incident ray reflected or refracted.

The light will reflect (total internal reflection) if the angle exceeds the critical angle. (1 mark)

$n_1 \sin\theta_1 = n_2 \sin\theta_2$

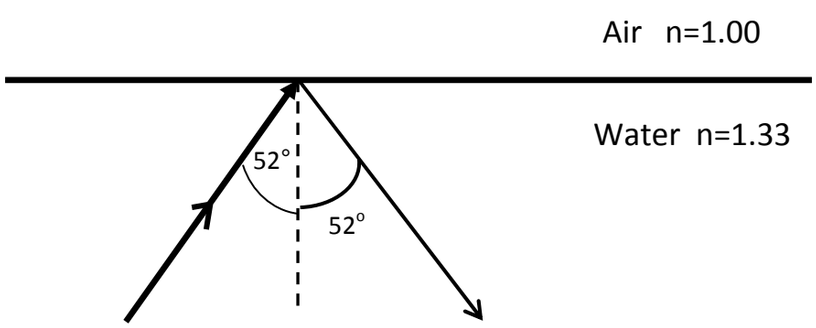
$1.33 \sin\theta_1 = 1.00 \sin 90^o$ (0.5 marks)

$\sin\theta_1 = 0.7519$

$\theta_1 = \sin^{-1} 0.7519 = 49^o$ (0.5 marks)

Since the incident angle (52^o) is greater than the critical angle, the light reflects. (1 mark)

1 (ii) On the diagram below, sketch the resulting ray when the lab was conducted.



3 (c) A 440 Hz tuning fork is held over an air column that is open at one end. If the temperature is 19° C, calculate the length of the air column that produces the second resonant sound.

$v_{sound} = 332 + 0.6T$

$v_{sound} = 332 + 0.6(19^{o}) = 343.4 \text{ m/s}$ (1 mark)

$\lambda = \frac{v}{f} = \frac{343.4}{440} = 0.780 \text{ m}$ (1 mark)

$L = \frac{3}{4}\lambda = \frac{3}{4}(0.780) = 0.59 \text{ m}$ (1 mark)

Question			Unit	Level	Marks	SCO	Pg. #
41	A	i	1	2	2	325-2	26
		ii	1	2	2	325-2	26
		iii	1	2	1	325-2	26
		iv	1	2	1	325-2	26
	b(STSE)		1	3	3	325-2	30
42	a	i	2	2	3	325-8	48
		ii	2	2	2	325-8	48
	b(STSE)		2	2	3	326-3	54
	c(STSE)		2	3	3	326-3	52
43	a		3	3	3	325-9	58
	b		3	2	3	326-1	66
	c		3	2	3	325-10, 326-8	68
44	a	i	4	2	2	327-5, 327-6, 327-7	88
		ii	4	2	2	327-5, 327-6, 327-7	88
	b	i	4	3	3	327-7, 327-8	84
		ii	4	2	1		84
	c(lab)		4	2	3	327-5, 327-8	92

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1: Knowledge/Comprehension
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