



554-534

Physics

**Comprehensive Exam
Number 54**

GUIDE

Secondary 5

September, 2004



Youth Sector General Education



1. GENERAL INFORMATION

- 1.1 Program: Physics, Secondary V
- 1.2 Origin: Science Coordinating Committee Examination, 2004.
- Computerization and graphics: Design Team and Martine Sanscartier
Revision : Patricia Juliano, BIM, Société GRICS
- 1.3 Time allotted: 2 hours 30 minutes
- 1.4 Number of questions: 27 distributed as follows:
18 multiple choice
9 constructed response
- 1.5 Authorized materials: - drawing instruments, graph paper
- list of formulas and quantities included
- scientific calculator with or without a graphic display

2. DESCRIPTION OF EXAM

The following table matches each of the examination questions with the corresponding dimension of the definition of the domain that was used for the examination.

Exam Specifications

Modules	Nature of Light 44%	Mechanics 56%
Skill		
Mastery of Concepts 36%	1, 2, 3, 4	9, 10, 11, 12, 13
Mastery of Applications 36% or 40%	5, 6, 7, 8	14, 15, 16, 17, 18
Mastery of Problem-Solving Techniques 24% or 28%	19, 20, 21, 22 (3 of 4)	23, 24, 25, 26 (A), 27 (4 of 5)

These percentages have been derived on the basis of the marks allotted for each question.

Although this table indicates that there are 27 questions, the student is required to answer only 25 of them. For questions 19, 20, 21 and 22, the student is required to answer only three of the four. For questions 23, 24, 25, 26 and 27, the student is required to answer four of the five.

**ITEM SPECIFICATIONS**

Question	MOD.TO.IO	T	S	D
Part A				
1	[2115] M01.01.03	M	C	F
2	[2116] M01.02.04	M	C	F
3	[2117] M01.02.06	M	C	F
4	[2118] M01.03.03	M	C	M
5	[2119] M01.04.03	M	A	M
6	[2120] M01.03.04	M	A	M
7	[2121] M01.05.07	M	A	M
8	[2122] M01.04.04	M	A	F
9	[2123] M03.01.06	M	C	F
10	[2124] M03.03.03	M	C	F
11	[2125] M03.01.01	M	C	F
12	[2126] M03	M	C	M
13	[2127] M03.05.03	M	C	F
14	[2128] M03.03.06	M	A	D
15	[2129] M03.03.02	M	A	M
16	[2130] M03.04.03	M	A	M
17	[2131] M03.05.04	M	A	M
18	[2132] M03.06.01	M	A	D
Part B				
19	[2133] M01.05.10	E	P	D
20	[2134] M01.03.08	E	P	D
21	[2135] M01.02.05	E	P	M
22	[2136] M01.05.13	E	P	D
Part C				
23	[2137] M03.02.04	E	P	M
24	[2138] M03.06.04	E	P	M
25	[2139] M03.03.04	E	P	D
26	[2140] M03.02.03	E	A	M
27	[2141] M03.03.05	E	P	D

Legend:

MOD : Modules M01: Nature of Light
M03: Mechanics

TO : Terminal objective
IO : Intermediate objective

T : Type M: multiple choice
E: extended answer (constructed response)

S : Skill C: Mastery of Concepts
A: Mastery of Applications
P: Mastery of Problem-Solving Techniques

D : Level of difficulty F: Easy
M: Medium
D: Difficult



3- CORRECTION KEY

Part A

4 marks or 0 marks

- 1 C
- 2 A
- 3 D
- 4 B
- 5 A
- 6 D
- 7 B
- 8 B
- 9 D
- 10 C
- 11 D
- 12 D
- 13 B
- 14 A
- 15 B
- 16 D
- 17 C
- 18 A



GUIDELINES FOR CORRECTING CONSTRUCTED-RESPONSE QUESTIONS

The marking scale for correcting the answers to the constructed-response questions of the examination is presented below, along with explanations of the terms used in the scale.

It is **IMPORTANT** that the teacher read this information carefully before correcting the examination.

Constructed-response questions usually consist of two parts: the **procedure** used to solve the problem and the **answer**. Thus, a constructed-response question should be corrected in two steps.

Step 1

Analyze the work to understand the procedure used by the student, and then decide if the procedure is appropriate or not.

A **procedure** is **appropriate** if the steps presented could lead to the correct answer.

A **procedure** is **partially appropriate** if the steps presented do not lead to the correct answer, but include at least one step that is relevant and correct.

A **procedure** is **inappropriate** if none of the steps presented are relevant or if the student has not shown any work.

Step 2

If the procedure is deemed appropriate, then evaluate the answer. If the answer is incorrect, identify the type of error made.

The **error** is considered **minor** if it is an error in calculation or transcription, if the unit of measurement is incorrect or missing, or if the student has rounded off a number incorrectly.

The **error** is considered **major** if a law, rule, or formula has been applied incorrectly.

No marks are allotted for a correct answer when the procedure used is inappropriate.

**Part B****19 Example of an appropriate and complete answer**

$$\text{Step 1 } M = \frac{h_i}{h_o} = \frac{-d_i}{d_o}$$

$$M = \frac{-1}{0.5} = \frac{-d_i}{d_o} \text{ (the image is inverted so } h_i \text{ is negative)}$$

$$\text{So } 2d_o = d_i$$

$$\text{Step 2 } \frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$

$$\frac{1}{d_o} + \frac{1}{2d_o} = \frac{1}{10}$$

$$d_o = 15 \text{ cm}$$

Answer: Sandra is holding the lens **15 cm** from the letter.

- 4 marks The student chose an appropriate procedure and applied it correctly; the final answer is correct.
- 3 marks The student chose an appropriate procedure, but made minor errors in applying it (i.e. calculations or transcription errors, incorrect units of measure, numbers rounded incorrectly).
- 2 marks The student chose an appropriate procedure, but made major errors in applying it (i.e. errors relating to methods, rules, laws, systems or theories.) (**e.g. Student did not set h_i negative.**)
- 1 mark The student's procedure was partially appropriate (i.e. it does not lead to the correct answer, but at least one of the steps is relevant and presented correctly.) (**e.g. Student only calculates the magnification.**)
- 0 marks The student showed no work (even if the answer is correct) or chose an inappropriate procedure; the answer is missing or incorrect, or it is correct purely by chance.

**20** Example of an appropriate and complete answer**Step 1**

Calculate the angle of incidence

$$\begin{aligned}i &= 90^\circ - \tan^{-1} \left(\frac{\text{opp}}{\text{adj}} \right) \\ &= 90^\circ - \tan^{-1} \left(\frac{1.5}{5.0} \right) \\ &= 90^\circ - 16.7^\circ \\ &= 73.3^\circ\end{aligned}$$

Step 2

Calculate the angle of refraction

$$\begin{aligned}n_1 \sin \theta_1 &= n_2 \sin \theta_2 \\ \theta_2 &= \sin^{-1} \left(\frac{n_1 \sin \theta_1}{n_2} \right) \\ &= \sin^{-1} \left(\frac{1 \times \sin 73.3}{1.33} \right) \\ &= 46.1^\circ\end{aligned}$$

Step 3

Calculate the depth of the fish

$$\begin{aligned}\tan \theta &= \left(\frac{\text{opp}}{\text{adj}} \right) \\ \text{adj} &= \left(\frac{\text{opp}}{\tan \theta} \right) \\ &= \left(\frac{15}{\tan 46.1^\circ} \right) \\ &= 14.4\end{aligned}$$

Answer: The fish is **14 m** below the surface of the water.**Note:** Other trigonometric solutions are acceptable.

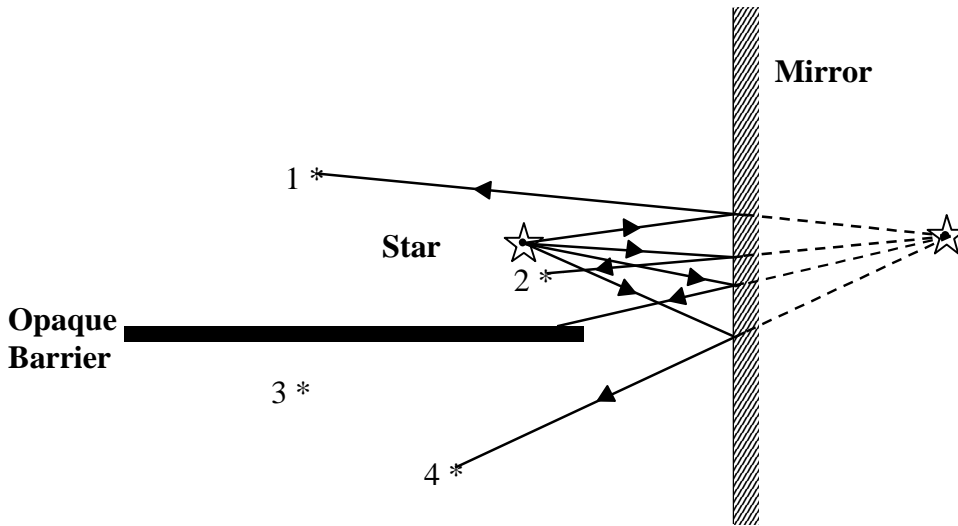
4 marks The student chose an appropriate procedure and applied it correctly; the final answer is correct.

3 marks The student chose an appropriate procedure, but made minor errors in applying it (i.e. calculations or transcription errors, incorrect units of measure, numbers rounded incorrectly).

2 marks The student chose an appropriate procedure, but made major errors in applying it (i.e. errors relating to methods, rules, laws, systems or theories.) (**e.g. Student did not determine the complementary angle.**)

1 mark The student's procedure was partially appropriate (i.e. it does not lead to the correct answer, but at least one of the steps is relevant and presented correctly.)

0 marks The student showed no work (even if the answer is correct) or chose an inappropriate procedure; the answer is missing or incorrect, or it is correct purely by chance.

21 Example of an appropriate and complete answer


Answer: The image of the star can be seen from positions **1, 2 and 4**.

Note that the star's image is equidistant in the mirror.

(3) is wrong because the barrier is in the way.

- 4 marks The student chose an appropriate procedure and applied it correctly; the final answer is correct.
- 3 marks The student chose an appropriate procedure, but made minor errors in applying it (i.e. calculations or transcription errors, incorrect units of measure, numbers rounded incorrectly). **(e.g. Arrowhead is missing.)**
- 2 marks The student chose an appropriate procedure, but made major errors in applying it (i.e. errors relating to methods, rules, laws, systems or theories.) **(e.g. Only the reflected rays are showing.)**
- 1 mark The student's procedure was partially appropriate (i.e. it does not lead to the correct answer, but at least one of the steps is relevant and presented correctly.) **(e.g. The student only located the image.)**
- 0 marks The student showed no work (even if the answer is correct) or chose an inappropriate procedure; the answer is missing or incorrect, or it is correct purely by chance.

**22 Example of an appropriate and complete answer****Step 1**

$$\begin{aligned}P_1 &= \frac{1}{f_1} \\ &= \frac{1}{-0.500} \\ &= -2.00 \text{ d}\end{aligned}$$

Step 2

$$\begin{aligned}P_T &= P_1 + P_2 + P_3 + P_4 \\ P_3 &= P_T - (P_1 + P_2 + P_4) \\ &= 10 - ((-2.00) + (4.40) + (-0.400)) \\ &= 8.00 \text{ d}\end{aligned}$$

Step 3

$$\begin{aligned}f_3 &= \frac{1}{P_3} \\ &= \frac{1}{8.00} \\ &= 0.125 \text{ m} \\ &= 12.5 \text{ cm}\end{aligned}$$

Step 4

$$\begin{aligned}\frac{1}{f} &= \frac{1}{d_i} + \frac{1}{d_o} \\ d_i &= \left(\frac{1}{f} - \frac{1}{d_o} \right)^{-1} \\ &= \left(\frac{1}{12.5} - \frac{1}{50.0} \right)^{-1} \\ &= (0.060)^{-1} \\ &= 16.7 \text{ cm}\end{aligned}$$

Answer: The distance to the screen is **16.7 cm**.

- 4 marks The student chose an appropriate procedure and applied it correctly; the final answer is correct.
- 3 marks The student chose an appropriate procedure, but made minor errors in applying it (i.e. calculations or transcription errors, incorrect units of measure, numbers rounded incorrectly).
- 2 marks The student chose an appropriate procedure, but made major errors in applying it (i.e. errors relating to methods, rules, laws, systems or theories.)
- 1 mark The student's procedure was partially appropriate (i.e. it does not lead to the correct answer, but at least one of the steps is relevant and presented correctly.)
- 0 marks The student showed no work (even if the answer is correct) or chose an inappropriate procedure; the answer is missing or incorrect, or it is correct purely by chance.

**Part C****23 Example of an appropriate and complete answer**

$$F = kx$$

$$F = (120 \text{ N/m})(0.5 \text{ m})$$

$$F = 60 \text{ N}$$

$$\text{AMA} = \frac{F_{\text{R}}}{F_{\text{E}}}$$

$$3 = \frac{60}{F_{\text{E}}}$$

$$F_{\text{E}} = 20 \text{ N}$$

Answer: The force needed to compress the spring by 0.50 m is **20 N**.

4 marks The student chose an appropriate procedure and applied it correctly; the final answer is correct.

3 marks The student chose an appropriate procedure, but made minor errors in applying it (i.e. calculations or transcription errors, incorrect units of measure, numbers rounded incorrectly).

2 marks The student chose an appropriate procedure, but made major errors in applying it (i.e. errors relating to methods, rules, laws, systems or theories.)

1 mark The student's procedure was partially appropriate (i.e. it does not lead to the correct answer, but at least one of the steps is relevant and presented correctly.)

0 marks The student showed no work (even if the answer is correct) or chose an inappropriate procedure; the answer is missing or incorrect, or it is correct purely by chance.

**24 Example of an appropriate and complete answer**

Decrease in $E_g =$ Gain in E_k

$$\begin{aligned} \text{Difference in } mgh &= \text{gain in } E_k \\ &= (1/2)(m)(v^2) \end{aligned}$$

Mass cancels from both sides so $gh = (1/2)(v^2)$

Change in height is 50 m and gravity is 9.8 m/s^2

$$\text{So } v^2 = (50)(9.8)/0.5$$

$$v = 31.3 \text{ m/s}$$

Answer: The rider's velocity at point B is **31.3 m/s**.

- 4 marks The student chose an appropriate procedure and applied it correctly; the final answer is correct.
- 3 marks The student chose an appropriate procedure, but made minor errors in applying it (i.e. calculations or transcription errors, incorrect units of measure, numbers rounded incorrectly).
- 2 marks The student chose an appropriate procedure, but made major errors in applying it (i.e. errors relating to methods, rules, laws, systems or theories.)
- 1 mark The student's procedure was partially appropriate (i.e. it does not lead to the correct answer, but at least one of the steps is relevant and presented correctly.)
- 0 marks The student showed no work (even if the answer is correct) or chose an inappropriate procedure; the answer is missing or incorrect, or it is correct purely by chance.

**25** Example of an appropriate and complete answer

Solution: *Malfoy*

$$v_2^2 = v_1^2 + 2a\Delta d$$

$$v_2^2 = (-2)^2 + 2(-9.8)(-20)$$

$$v_2^2 = 4 + 392$$

$$v_2^2 = 396$$

$$v_2 = 19.9 \text{ m/s down or } -19.9 \text{ m/s}$$

$$v_2 = v_1 + a\Delta t$$

$$-19.9 = -2 + (-9.8)\Delta t$$

$$\Delta t = 1.8 \text{ sec.}$$

Potter

$$v = \frac{\Delta d}{\Delta t}$$

$$25 = \frac{75}{\Delta t}$$

$$\Delta t = 3 \text{ sec.}$$

$$3 \text{ s} - 1.8 \text{ s} = 1.2 \text{ sec.}$$

Answer: Malfoy will be first to reach the snitch with **1.2 s** to spare!

- 4 marks The student chose an appropriate procedure and applied it correctly; the final answer is correct.
- 3 marks The student chose an appropriate procedure, but made minor errors in applying it (i.e. calculations or transcription errors, incorrect units of measure, numbers rounded incorrectly).
- 2 marks The student chose an appropriate procedure, but made major errors in applying it (i.e. errors relating to methods, rules, laws, systems or theories.) **(e.g. Calculated Malfoy's and Potter's time, but omitted the time difference.)**
- 1 mark The student's procedure was partially appropriate (i.e. it does not lead to the correct answer, but at least one of the steps is relevant and presented correctly.) **(e.g. Only calculated Potter's time.)**
- 0 marks The student showed no work (even if the answer is correct) or chose an inappropriate procedure; the answer is missing or incorrect, or it is correct purely by chance.

**26 Example of an appropriate and complete answer**

$$\begin{aligned}\sum F_x &= (\cos 25^\circ)(T_2) - (\cos 75^\circ)(T_1) \\ &= 0\end{aligned}$$

$$T_1 = \frac{(\cos 25^\circ)(T_2)}{(\cos 75^\circ)}$$

$$T_1 = 3.5 T_2$$

$$\begin{aligned}\sum F_y &= (\sin 75^\circ)(T_1) + (\sin 25^\circ)(T_2) - 980 \text{ N} \\ &= 0\end{aligned}$$

Substituting $3.5 T_2$ for T_1

$$(\sin 75^\circ)(3.5 T_2) + (\sin 25^\circ)(T_2) - 980 \text{ N} = 0$$

$$3.38 T_2 + 0.423 T_2 = 980 \text{ N}$$

$$3.80 T_2 = 980 \text{ N}$$

$$T_2 = 980 / 3.80$$

$$T_2 = 257.6 \text{ N}$$

$$\text{Therefore } T_1 = 3.5 T_2$$

$$= 3.5 \times 257.6$$

$$= 901.9 \text{ N}$$

Answer: The tension on T_1 is **902 N**.
The tension on T_2 is **258 N**.

Note: Other trigonometric or scale diagram solutions are also acceptable.

4 marks The student chose an appropriate procedure and applied it correctly; the final answer is correct.

3 marks The student chose an appropriate procedure, but made minor errors in applying it (i.e. calculations or transcription errors, incorrect units of measure, numbers rounded incorrectly).

2 marks The student chose an appropriate procedure, but made major errors in applying it (i.e. errors relating to methods, rules, laws, systems or theories.)

1 mark The student's procedure was partially appropriate (i.e. it does not lead to the correct answer, but at least one of the steps is relevant and presented correctly.)

0 marks The student showed no work (even if the answer is correct) or chose an inappropriate procedure; the answer is missing or incorrect, or it is correct purely by chance.

**27 Example of an appropriate and complete answer****Calculate Titov's distance**

$$\begin{aligned}\Delta d &= v \times \Delta t \\ &= 42.0 \text{ m/s} \times 5 \text{ h} \times 3600 \text{ s/h} \\ &= 756\,000 \text{ m or } 7.56 \times 10^2 \text{ km}\end{aligned}$$

Calculate Dimitri's distance

$$\begin{aligned}\Delta d &= v \times \Delta t \\ &= 28.0 \text{ m/s} \times 4.5 \text{ h} \times 3600 \text{ s/h} \\ &= 453\,600 \text{ m or } 4.54 \times 10^2 \text{ km}\end{aligned}$$

Calculate the total distance

$$\begin{aligned}\Delta d_{\text{total}} &= \Delta d_{\text{Titov}} + \Delta d_{\text{Dimitri}} \\ &= (7.56 \times 10^2 \text{ km}) + (4.54 \text{ m/s} \times 10^2 \text{ km}) \\ &= 1.21 \times 10^3 \text{ km}\end{aligned}$$

Answer: The distance between the two cities is **$1.21 \times 10^3 \text{ km}$** .

- 4 marks The student chose an appropriate procedure and applied it correctly; the final answer is correct.
- 3 marks The student chose an appropriate procedure, but made minor errors in applying it (i.e. calculations or transcription errors, incorrect units of measure, numbers rounded incorrectly).
- 2 marks The student chose an appropriate procedure, but made major errors in applying it (i.e. errors relating to methods, rules, laws, systems or theories.)
- 1 mark The student's procedure was partially appropriate (i.e. it does not lead to the correct answer, but at least one of the steps is relevant and presented correctly.)
- 0 marks The student showed no work (even if the answer is correct) or chose an inappropriate procedure; the answer is missing or incorrect, or it is correct purely by chance.



554-534

Physics

**Comprehensive Exam
Number 54**

Question Booklet

Secondary 5

September, 2004



Youth Sector General Education



INSTRUCTIONS

1. Write the required information on the title page of the Answer Booklet.
2. Answer all questions in the Answer Booklet. Each question is worth four marks.
3. In Part B, you are to answer 3 of the 4 questions.
4. In Part C, you are to answer 4 of the 5 questions.
5. You may use drawing instruments, graph paper and a scientific calculator with or without a graphic display.
6. You may refer to the lists of formulas and quantities included in this Question Booklet. The use of any other reference material is strictly forbidden.
7. Hand in both the Question Booklet and the Answer Booklet at the end of the exam session.

Note: Figures are **NOT** necessarily drawn to scale.

Time allotted: 2 hours 30 minutes



EQUATIONS		
OPTICS	MECHANICS	
$n_1 \sin \theta_1 = n_2 \sin \theta_2$	$v_{av} = \frac{\Delta d}{\Delta t}$	$F_E l_E = F_R l_R$
$M = \frac{h_i}{h_o}$	$a = \frac{\Delta v}{\Delta t}$	$E_g = mgh$
$\frac{h_i}{h_o} = -\frac{d_i}{d_o}$	$\Delta d = v_1 \Delta t + \frac{1}{2} a (\Delta t)^2$	$E_k = \frac{1}{2} mv^2$
$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$	$v_2 = v_1 + a \Delta t$	$F_E \Delta d_E = F_R \Delta d_R$
$P = \frac{I}{f}$	$v_2^2 = v_1^2 + 2a \Delta d$	$F = ma$
$P_t = P_1 + P_2 + \dots + P_n$	$P = \frac{W}{\Delta t}$	$F_g = mg$
	$W = F \Delta d$	$F = kx$

PHYSICAL CONSTANTS		
SYMBOL	QUANTITY	VALUE
c	Speed of light in a vacuum	3.00×10^8 m/s
g	Acceleration due to gravity (earth)	9.8 m/s ²

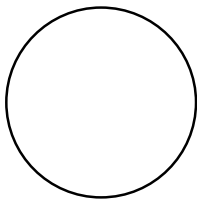


Part A

Questions 1 to 18

Blacken the letter that corresponds to your answer in the Answer Booklet.

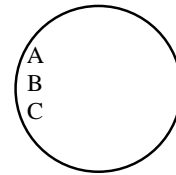
- 1 When only the Moon's penumbral shadow strikes Earth, we see a partial eclipse of the Sun from that region.



Sun



Moon

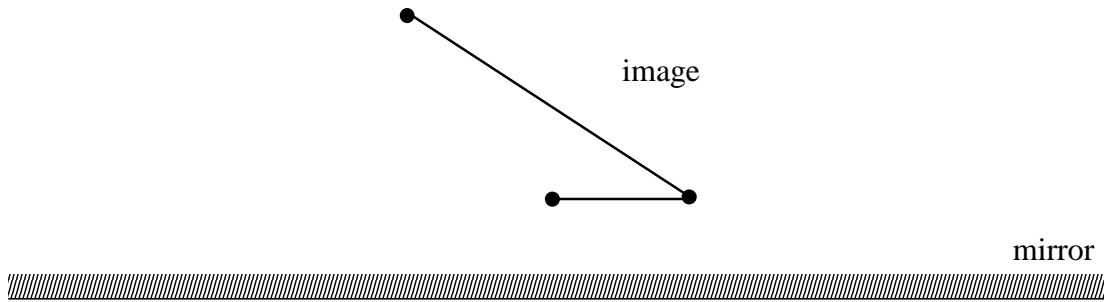


Earth

In which region(s) on Earth do we see a partial eclipse of the Sun?

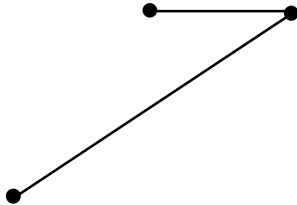
- A) Region A only
- B) Region B only
- C) Regions A and C
- D) Regions A, B and C

2 Below is a virtual image created in a plane mirror.

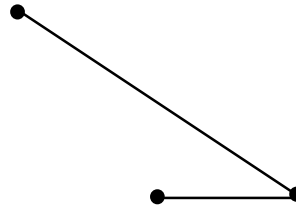


Which of the following objects would create the virtual image above?

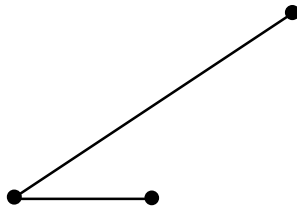
A)



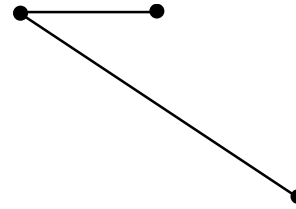
C)



B)



D)



3 Which of the following always describes the real image formed in front of a curved mirror?

- A) Bigger than the object
- B) Smaller than the object
- C) Erect
- D) Inverted



4 In a computer system, the monitor and the printer create colour in different ways. The monitor creates colour using the "Additive Theory" while the printer creates colour using the "Subtractive Theory".

Consider the following statements:

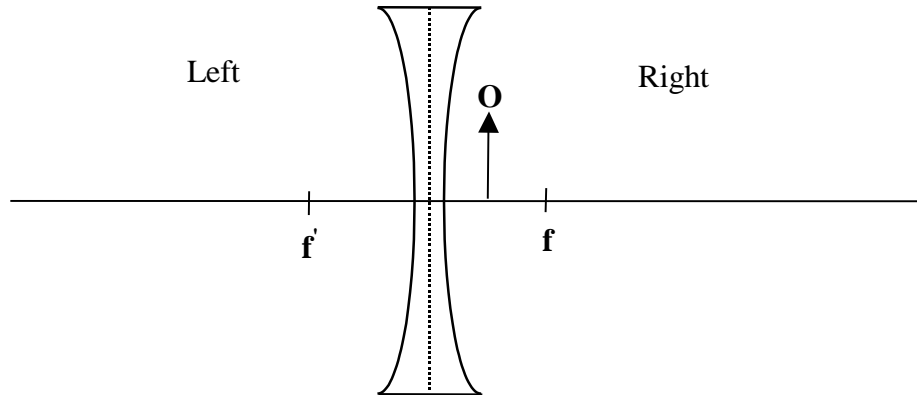
1. The monitor creates yellow by combining red and green light.
2. The printer creates red by combining magenta and yellow ink.
3. The monitor creates yellow by combining green and blue light.
4. The printer creates yellow by combining red and green ink.
5. The monitor creates magenta by combining red and blue light.
6. The printer creates blue by combining cyan and magenta ink.
7. The monitor creates white by combining red, green, and blue light.
8. The printer creates white by combining cyan, magenta, and yellow ink.

Which of the following combinations contains only correct statements?

- A) 1, 4 and 5
- B) 1, 5 and 6
- C) 3, 6 and 7
- D) 6, 7 and 8



- 5 An object (O) is placed close to a diverging lens, as shown below.

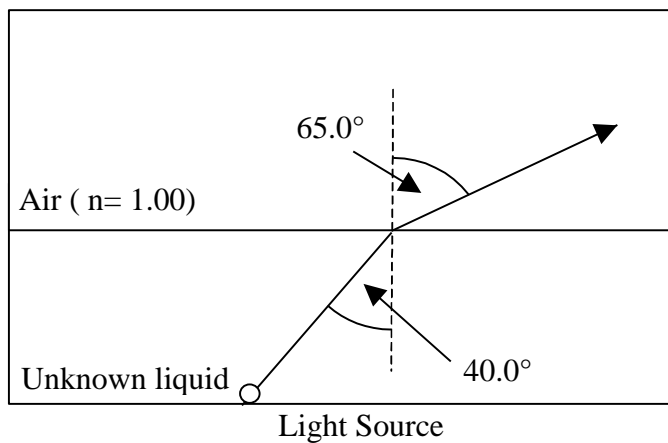


Which of the following describes the image's location, type, attitude and size?

- A) The image will be on the right side of the lens, virtual, upright and smaller than the object.
- B) The image will be on the right side of the lens, real, upright and smaller than the object.
- C) The image will be on the left side of the lens, real, inverted and larger than the object.
- D) The image will be on the left side of the lens, virtual, inverted and larger than the object.

- 6 Ally and Conor perform an experiment in the lab. They place a light source at the bottom of a container filled with an unknown liquid.

The light source in the unknown liquid gives off a ray that passes into air (as shown) and the results are recorded in the table below.



Angle of Incidence	Angle of Refraction
40.0°	65.0°

Based on the data collected, Ally and Conor calculated the critical angle of a ray in this set up.

What is the critical angle of a ray travelling from the unknown liquid into air?

- A) 1.41°
- B) 21.4°
- C) 38.0°
- D) 45.2°



7 Alex places a 5.00 cm tall candle 30.0 cm in front of a mirror that has a focal length of -50.0 cm.

What is the magnification of the candle?

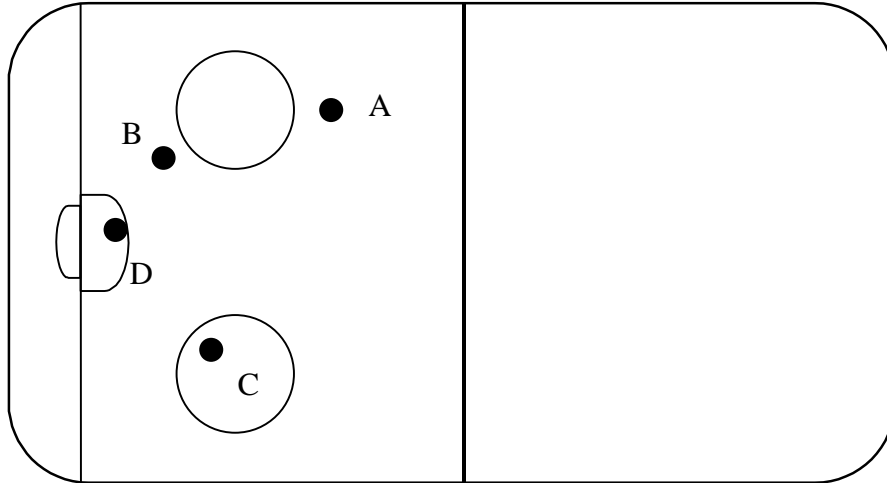
- A) + 1.60
- B) + 0.63
- C) - 0.63
- D) - 1.63

8 In an experiment, you found the focal length of a lens system to be 25 cm.

What is the optical power of this system?

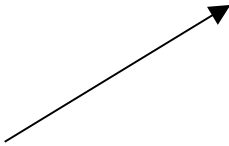
- A) 4.0 cm
- B) 4.0 d
- C) 0.04 cm
- D) 0.04 d

- 9 During a power play attack in a hockey game, player A passes the puck to player C, who passes the puck to player B, who shoots the puck at the net and the goalie (D) catches it.

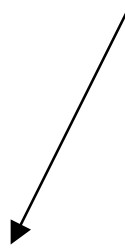


Which vector best represents the displacement of the puck?

A)



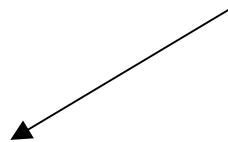
C)



B)



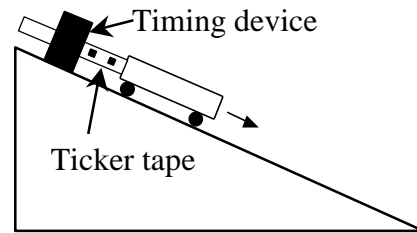
D)





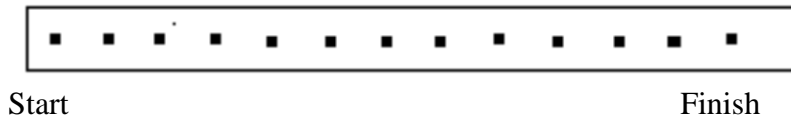
- 10 A cart, starting from rest, rolls down a ramp.

A "ticker tape" attached to the rear of the cart passes through a timing device that marks the tape every tenth of a second.

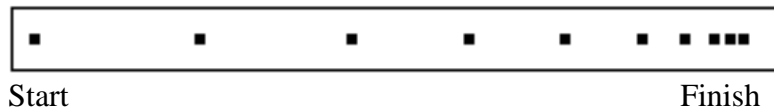


Which ticker tape below shows the motion of the cart?

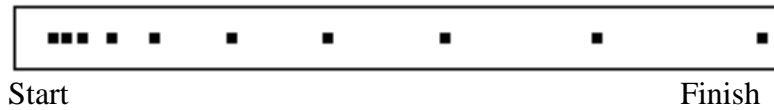
- A) Ticker Tape 1



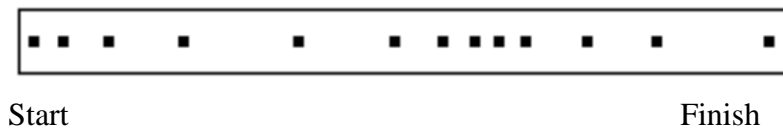
- B) Ticker Tape 2



- C) Ticker Tape 3

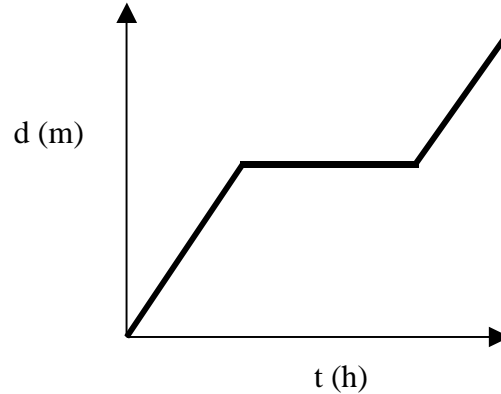


- D) Ticker Tape 4





- 11 Examine the position-time graph below.



Which of the following most accurately describes the motion represented in the graph?

- A) Increasing velocity, followed by constant velocity, followed by increasing velocity
- B) Increasing velocity, followed by zero velocity, followed by increasing velocity
- C) Constant velocity, followed by constant velocity, followed by constant velocity
- D) Constant velocity, followed by zero velocity, followed by constant velocity

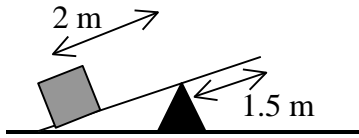
- 12 Which of the following is NOT equivalent to a unit for acceleration?

- A) $\frac{\text{J}}{\text{m}}$
kg
- B) $\frac{\text{N}}{\text{kg}}$
- C) $\frac{\text{m}}{\text{s}^2}$
- D) $\frac{\text{kg} \cdot \text{m}}{\text{s}^2}$

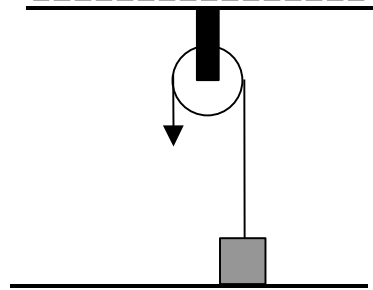
13 Patrick needs to lift a 100 kg load by applying less than 980 N of force.

Ignoring friction, which of the following simple machines should he NOT choose?

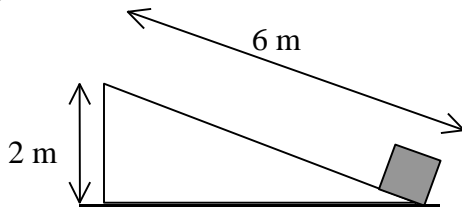
1.



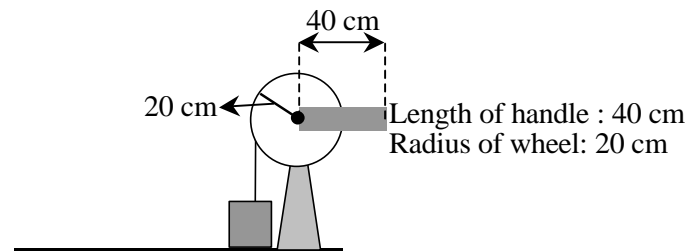
3.



2.



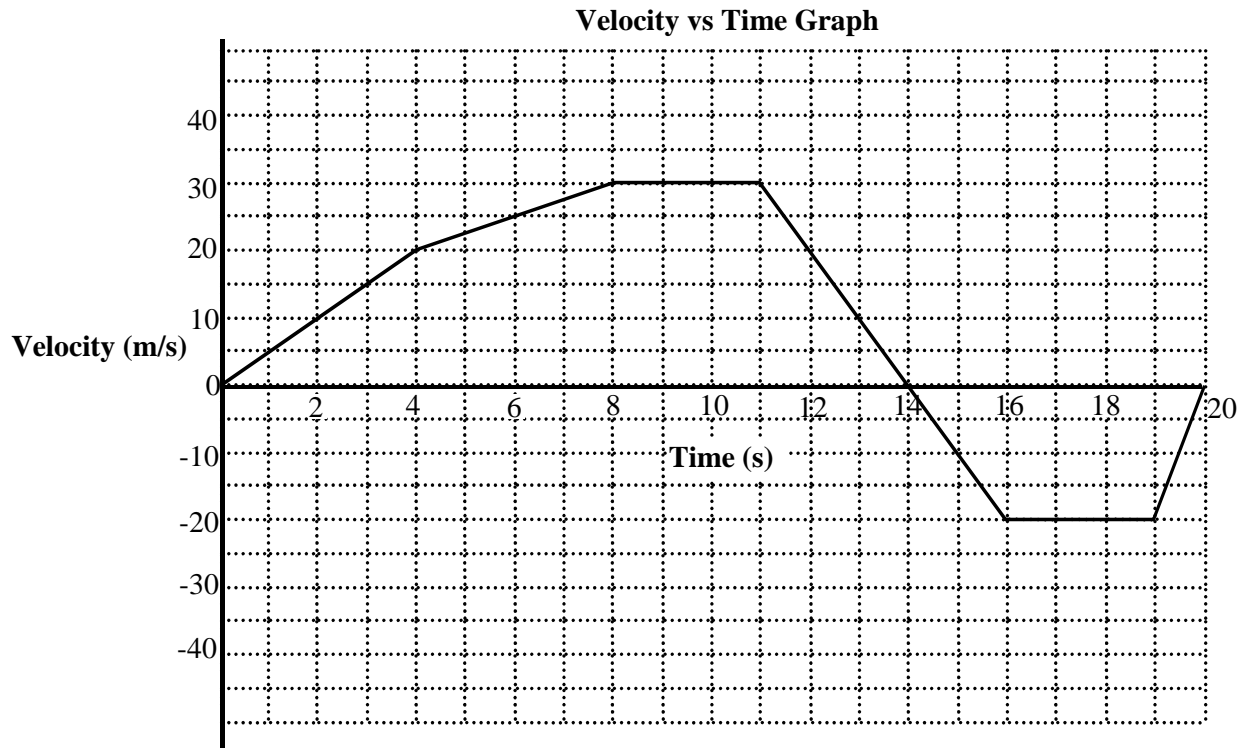
4.



- A) Simple machine 3 only
- B) Simple machines 1 and 3
- C) Simple machines 2 and 4
- D) Simple machines 1, 2 and 4



- 14 The graph below represents the velocity of a dandelion seed blowing in the wind for 20 seconds.



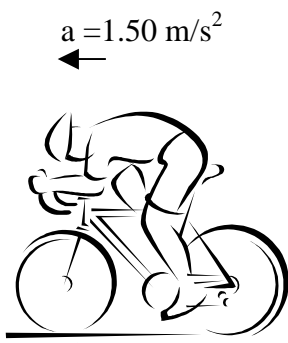
What is the displacement of the dandelion seed from the 4th second to the 20th second?

- A) 145 m
- B) 185 m
- C) 325 m
- D) 365 m

- 15 Laura propels a stone straight up with her slingshot. The stone strikes a tree branch 4.0 m above her. It strikes the branch with a velocity of 5.0 m/s.

How long does this take?

- A) 0.42 s
B) 0.53 s
C) 1.6 s
D) 10 s
- 16 As Archie pedals his bicycle, he applies a horizontal force of 160 N on the ground. His mass is 70.0 kg and the mass of his bicycle is 10.0 kg.



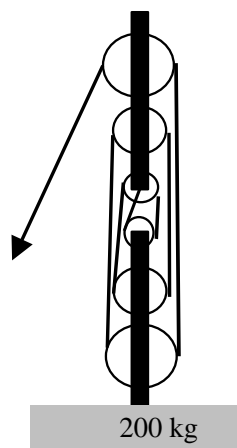
What is the magnitude of the resistance forces (friction and air resistance) at the moment his acceleration is 1.50 m/s^2 ?

- A) 280 N
B) 265 N
C) 55.0 N
D) 40.0 N

- 17 John, the zookeeper, uses the hoist shown on the right to raise an unconscious lion in its cage. The total mass to be raised is 200 kg.

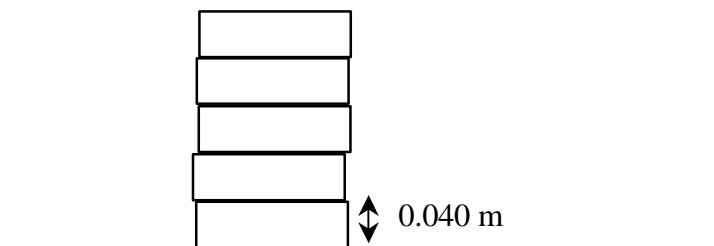
John can pull 5.00 m of rope in 10.0 seconds, assuming no friction.

How powerful is he?



- A) 17.0 W
- B) 100 W
- C) 163 W
- D) 980 W

- 18 A construction worker does 80 J of work against gravity to stack 5 identical boards, one on top of the other. Each board is 0.040 m thick.



What is the mass of one board?

- A) 2.0×10^1 kg
- B) 5.1×10^1 kg
- C) 2.0×10^2 kg
- D) 5.0×10^2 kg

Parts B and C of the examination comprise questions for which you must show all your work. Answer all these questions in the answer booklet. Show all the work needed to solve the problem: **data given, explanations, formulas** and **calculations**. Then write your answer in the space provided. You will be given no marks if you provide the right answer without showing your work. However, you will be given part marks for work that is partially correct. Where necessary, corrections will take into account the units of measurement.

PART B

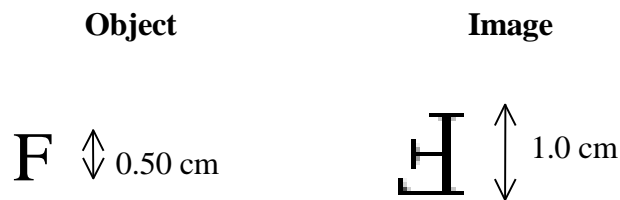
Questions 19, 20, 21 and 22

Choose any **three** of these questions and answer them in this answer booklet.

If you answer all four questions, **circle the numbers of the three** that you want marked. If you do not circle the three you want marked, only questions 19, 20 and 21 will be marked.

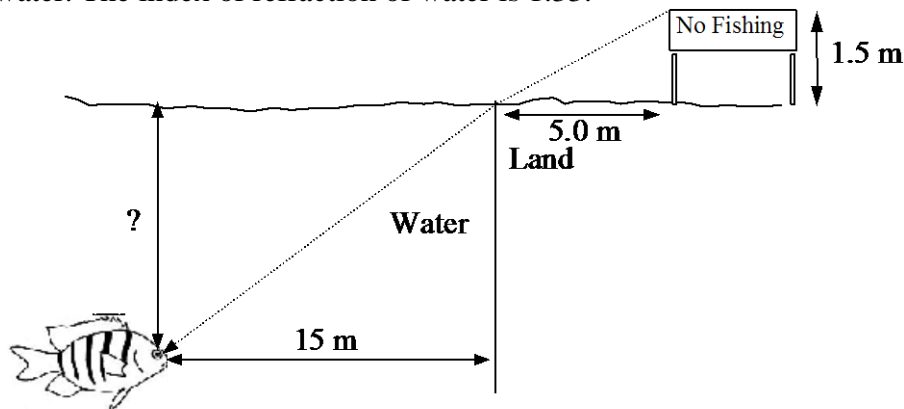
Each question is worth four marks.

- 19 Sandra views the letter **F** while looking through a double convex lens with a focal length of 10 cm. She notices the following:



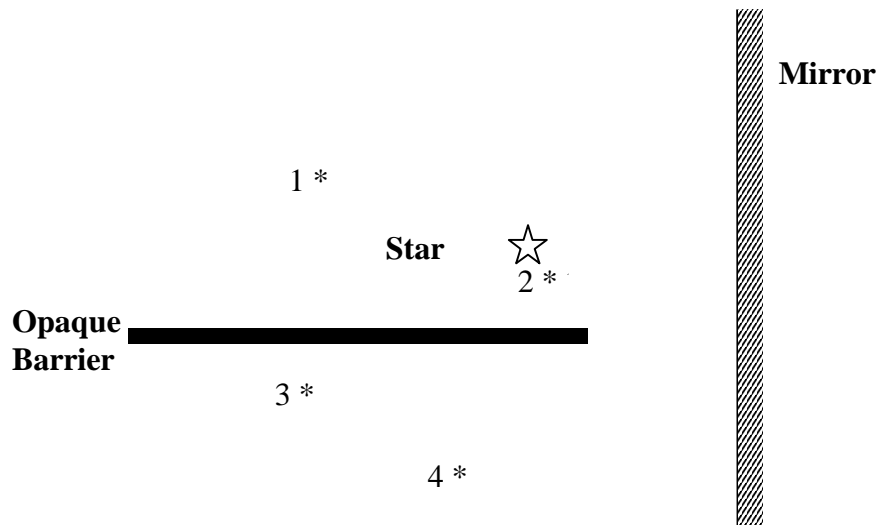
How close is Sandra holding the lens from the letter?

- 20 A fish located 15 m from shore can just see the top of a sign 1.5 m high located 5.0 m from the edge of the water. The index of refraction of water is 1.33.



At what depth below the surface of the water is the fish?

- 21 From which numbered position can the image of the star in the diagram below be seen in the mirror?



Your solution must include a complete ray diagram.

- 22 In a recent experiment using a system of four lenses, you obtained the following data:

Lens	1	2	3	4	All 4 lenses together
Focal length (m)	-0.500	+0.227		-2.50	+0.100
Optical power (d)		+4.40		-0.400	10.0

In another experiment, you used only lens number 3 to project an image of an object onto a screen. The object is located 50.0 cm from the lens.

How far is the lens from the screen?

PART C

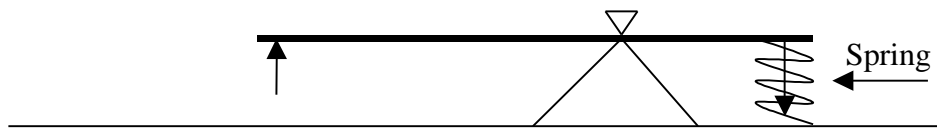
Questions 23, 24, 25, 26 and 27

Choose any **four** of these questions and answer them in the Answer Booklet.

If you answer all five questions, **circle the numbers of the four** that you want marked. If you do not circle the four you want marked, only questions 23, 24, 25 and 26 will be marked.

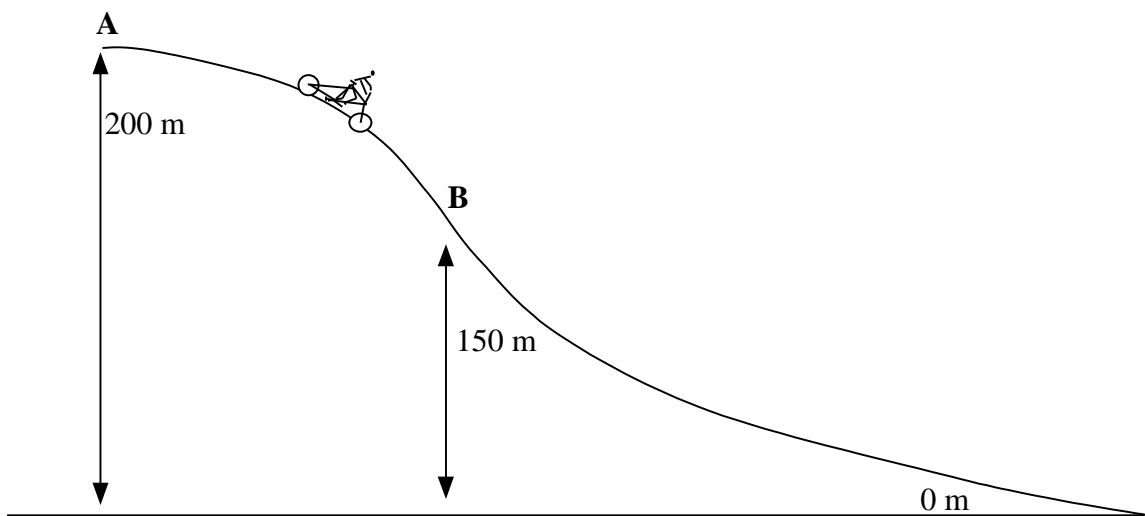
Each question is worth four marks.

- 23 JT wants to compress a coil with a spring constant of 120 N/m , shown below, using a lever with an AMA of 3.



How much effort force must JT apply to the lever to compress the spring by 0.50 m ?

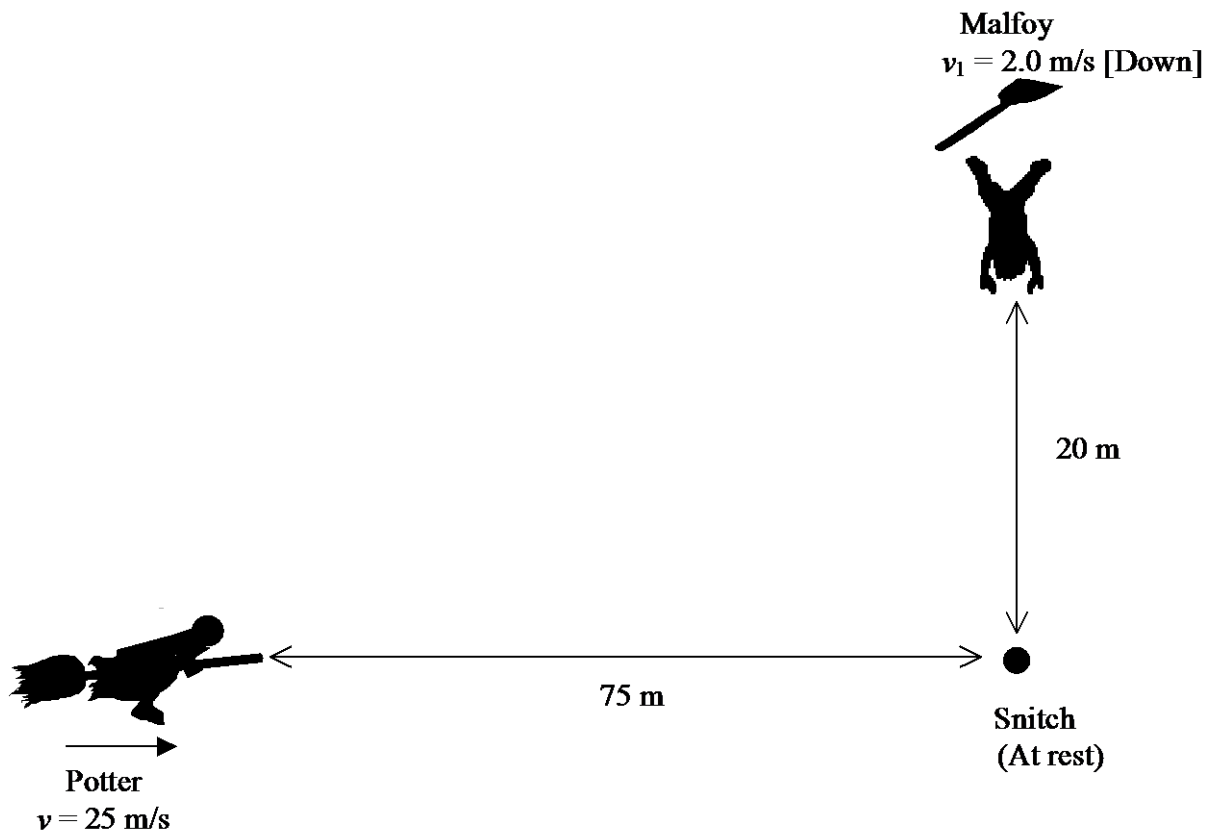
- 24 A mountain bike rider starts at rest at point **A**, 200 m above the base of a mountain and descends the slope without pedaling. (Friction is negligible)



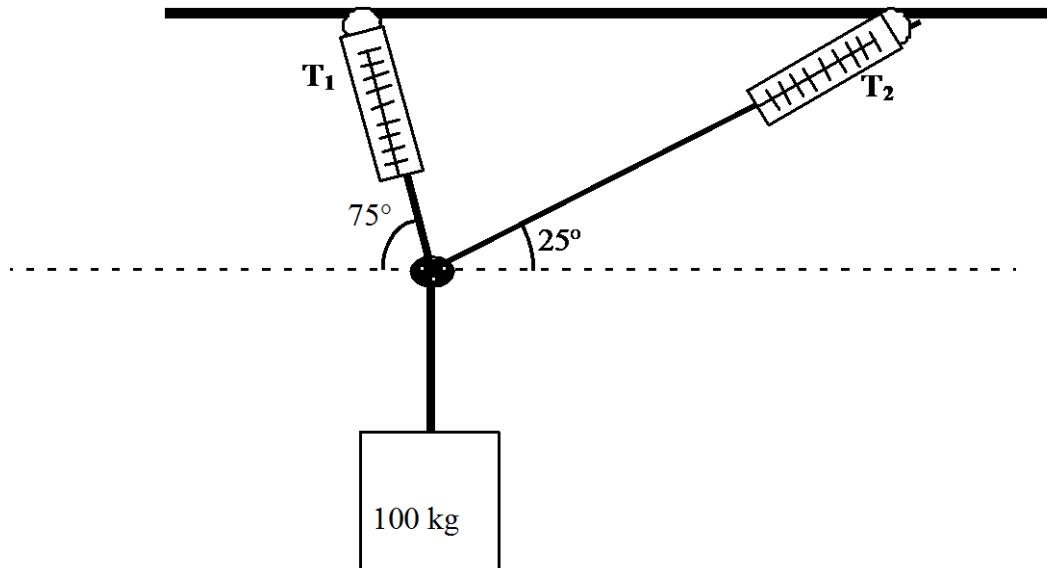
What is his velocity at point **B**, 150 m above the base of the mountain?

- 25 During a Quidditch match, Potter and Malfoy are chasing the snitch. Trying to catch the snitch first, Malfoy dives off his broom at 2 m/s [Down], from a height of 20 m from the snitch, while Potter is racing towards the snitch at a constant speed of 25 m/s for 75 m.

Who will make it to the snitch first and with how much time to spare? (Assume the snitch is at rest.)



- 26 Two dynamometers (spring scales) are used to suspend a 100 kg package, as shown.



Calculate the tension on each of the dynamometers.

- 27 Titov and Dimitri are travellers on the Siberian Railway. Titov's train leaves Irkutsk for Krasnoyarsk travelling at an average speed of 42.0 m/s. Dimitri's train leaves Krasnoyarsk 30 minutes later heading towards Irkutsk on a parallel track and travelling at an average speed of 28.0 m/s. Titov's train travels for 5.00 hours before meeting Dimitri's train.

What is the distance in kilometers between the two cities?



554-534

Physics

**Comprehensive Exam
Number 54**

Answer Booklet

Secondary 5

September, 2004

Student's Name	
Group	Date



Youth Sector General Education



PART A

Questions 1 to 18

Blacken the letter that corresponds to your answer.

Each question is worth four marks.

1 [A] [B] [C] [D]

2 [A] [B] [C] [D]

3 [A] [B] [C] [D]

4 [A] [B] [C] [D]

5 [A] [B] [C] [D]

6 [A] [B] [C] [D]

7 [A] [B] [C] [D]

8 [A] [B] [C] [D]

9 [A] [B] [C] [D]

10 [A] [B] [C] [D]

11 [A] [B] [C] [D]

12 [A] [B] [C] [D]

13 [A] [B] [C] [D]

14 [A] [B] [C] [D]

15 [A] [B] [C] [D]

16 [A] [B] [C] [D]

17 [A] [B] [C] [D]

18 [A] [B] [C] [D]

**PART B**

Questions 19, 20, 21 and 22

Choose any **three** of these questions and answer them in this answer booklet.

If you answer all four questions, **circle the numbers of the three** that you want marked.
If you do not circle the three you want marked, only questions 19, 20 and 21 will be marked.

Each question is worth four marks.

19

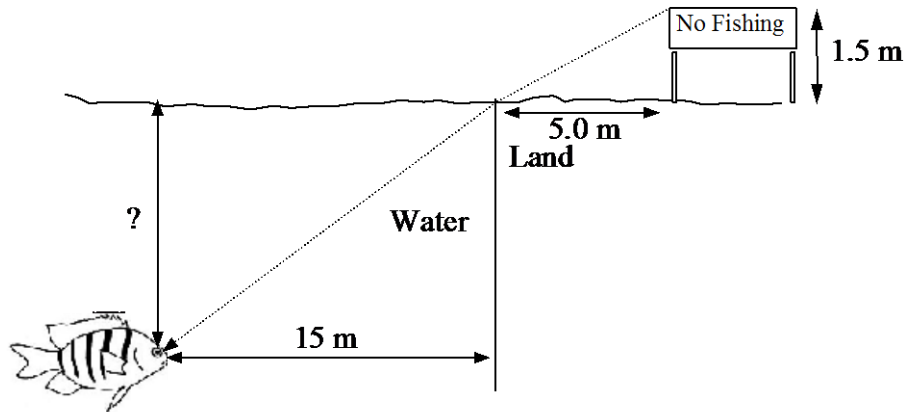
SHOW ALL YOUR WORK**Object****F** \updownarrow 0.5 cm**Image****H** \updownarrow 1 cm

(You must include correct units.)

Answer: Sandra is holding the lens _____ from the letter.

4	3	2	1	0
---	---	---	---	---

20

SHOW ALL YOUR WORK

(You must include correct units.)

Answer: The fish is _____ below the surface of the water.

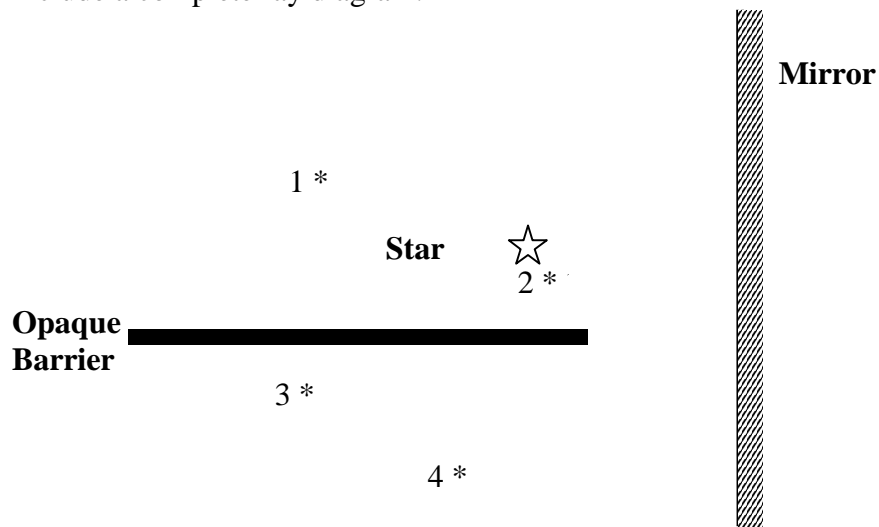
4	3	2	1	0
---	---	---	---	---



21

SHOW ALL YOUR WORK

Be sure to include a complete ray diagram.



Answer: The image of the star can be seen from position(s) _____.

4	3	2	1	0
---	---	---	---	---



22

SHOW ALL YOUR WORK

Lens	1	2	3	4	All 4 lenses together
Focal length (m)	-0.500	+0.227		-2.50	+0.100
Optical power (d)		+4.40		-0.400	10.0

(You must include correct units.)

Answer: The distance to the screen is _____.

4	3	2	1	0
---	---	---	---	---

PART C

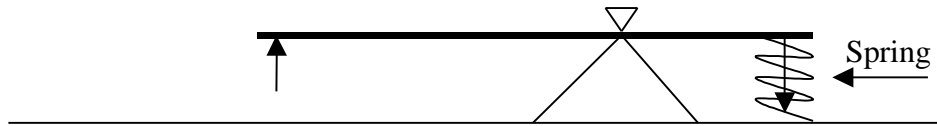
Questions 23, 24, 25, 26 and 27

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Each question is worth four marks.

23

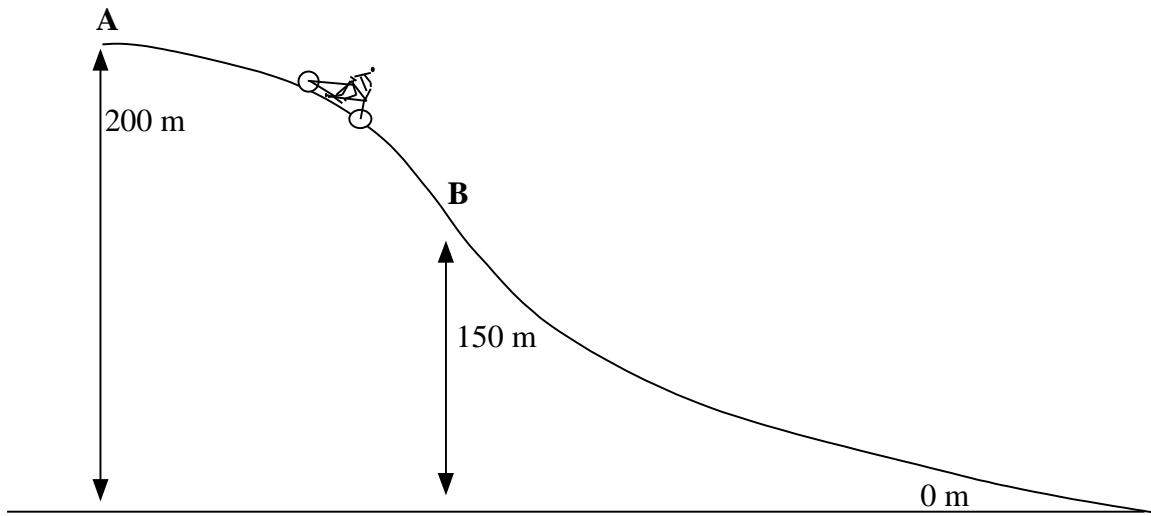
SHOW ALL YOUR WORK

(You must include correct units.)

Answer: The force needed to compress the spring by 0.5 m is _____.

4	3	2	1	0
---	---	---	---	---

24

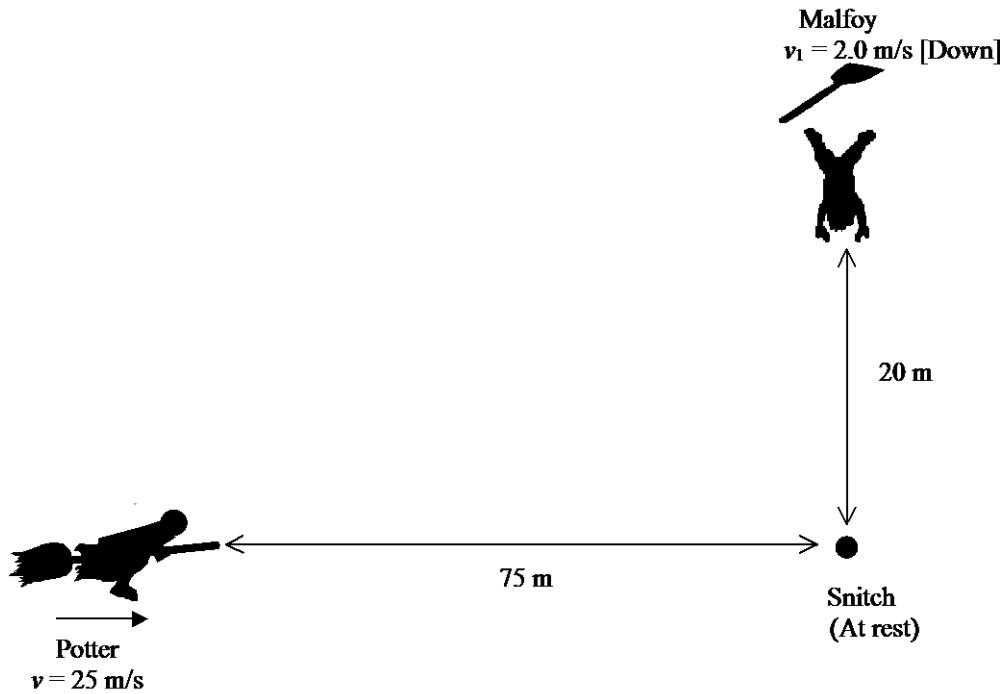
SHOW ALL YOUR WORK

(You must include correct units.)

Answer: The rider's velocity at point B is _____.

4	3	2	1	0
---	---	---	---	---

25

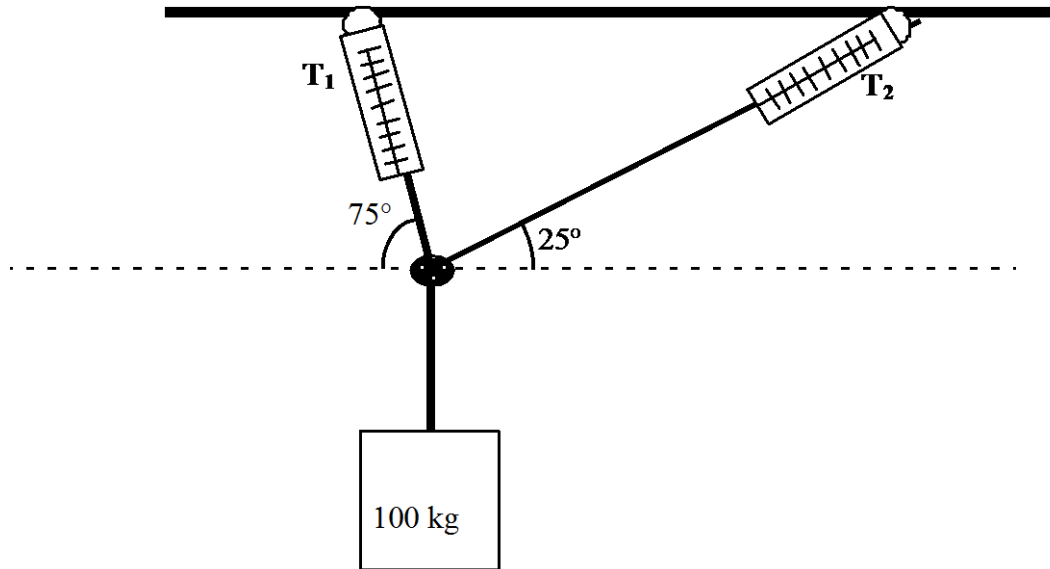
SHOW ALL YOUR WORK


(You must include correct units.)

 Answer: _____ will be first to reach the snitch with
 _____ to spare.

4	3	2	1	0
---	---	---	---	---

26

SHOW ALL YOUR WORK

(You must include correct units.)

Answer: The tension on T_1 is _____.
The tension on T_2 is _____.

4	3	2	1	0
---	---	---	---	---



27

SHOW ALL YOUR WORK

(You must include correct units.)

Answer: The distance between the two cities is _____.

4	3	2	1	0
---	---	---	---	---