GRICS

554-534

Physics

Comprehensive Exam
Number 53

GUIDE

Secondary 5

August, 2003

Youth Sector General Education

1. GENERAL INFORMATION

1.1 Program: Physics, Secondary V

1.2 Origin: Science Coordinating Committee Examination, 2003.

Computerization and graphics: Jim Daskalakis 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 / Skill	Nature of Light 44%	Mechanics 56%
Mastery of Concepts 36%	2, 4, 7, 8	9, 10, 11, 17, 18
Mastery of Applications 36%	1, 3, 5, 6	12, 13, 14, 15, 16
Mastery of Problem-Solving Techniques 28%	19, 20, 21, 22 (3 of 4)	23, 24, 25, 26, 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	[2088]	M01.01.03	M	A	E
2	[2089]	M01.02.04	M	C	E
3	[2090]	M01.02.05	M	A	M
4	[2091]	M01.03.03	M	C	E
5	[2092]	M01.05.02	M	A	M
6	[2093]	M01.03.07	M	A	D
7	[2094]	M01.02.06	M	C	M
8	[2095]	M01.05.09	M	C	E
9	[2096]	M03.01.06	M	C	E
10	[2097]	M03.03.05	M	C	E
11	[2098]	M03.03.03	M	C	M
12	[2099]	M03.03.01	M	A	M
13	[2100]	M03.02.08	M	A	M
14	[2101]	M03.02.03	M	A	D
15	[2102]	M03.04.04	M	A	M
16	[2103]	M03.06.02	M	A	D
17	[2104]	M03.05.02	M	C	E
18	[2105]	M03.06.01	M	C	M
Part B					
19	[2106]	M01.04.04	E	P	M
20	[2107]	M01.03.04	E	P	M
21	[2108]	M01.05.07	E	P	D
22	[2109]	M01.05.13	E	P	D
Part C					
23	[2110]	M03.04.08	E	P	D
24	[2111]	M03.02.04	E	P	D
25	[2112]	M03.03.09	E	P	M
26	[2113]	M03.05.05	E	P	D
27	[2114]	M03.06.07	E	P	M

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
- E: Easy
- M: Medium
- D: Difficult

3- CORRECTION KEY

Part A

4 marks or 0 marks

1 A

2 D

3 B

4 C

5 B

6 B

7 C

8 A

9 B

10 C

11 B

12 D

13 B

14 A

15 D

16 D

17 C

18 D

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**

Calculating optical power of lens A

$$P_A = \frac{1}{f_A} = \frac{1}{0.05\,\text{m}} = 20\,\text{d}$$

Calculating optical power of lens B

$$P_B = \frac{1}{f_B} = \frac{1}{0.20\,\text{m}} = 5\,\text{d}$$

Calculating optical power of lens C

$$P_T = P_A + P_B + P_C$$
$$P_C = P_T - (P_A + P_B)$$
$$= 15\,\text{d} - (20\,\text{d} + 5\,\text{d})$$
$$= -10\,\text{d}$$

Focal length of lens C

$$f_C = \frac{1}{P_C} = \frac{1}{-10\,\text{d}} = -0.10\,\text{m}$$

Answer: The focal length of lens C is **-0.10 m.**

Note: Do not penalize students for leaving out negative in focal length.

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 does not calculate the optical power of lens A or B correctly.)**

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 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**

Angle of reflection

$90° - 70° = 20°$

Angle of reflection = Angle of refraction = 20°

Calculating index of refraction of unknown medium

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

$$n_2 = \frac{n_1 \sin\theta_1}{\sin\theta_2}$$

$$n_2 = \frac{(1.00)(\sin 40°)}{\sin 20°}$$

$n_2 = 1.88$

Answer: The index of refraction of the unknown medium is **1.88**.

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 uses 70° for angle of refraction.)**

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 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**

Calculating distance of image

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$
$$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o}$$
$$\frac{1}{d_i} = \frac{1}{0.50\ \text{m}} - \frac{1}{1.5\ \text{m}}$$
$$\frac{1}{d_i} = 1.33$$
$$d_i = 0.75\ \text{m}$$

Calculating height of image

$$\frac{h_i}{h_o} = -\frac{d_i}{d_o}$$
$$h_i = -\frac{d_i\, h_o}{d_o}$$
$$h_i = -\frac{(0.75\ \text{m})(0.10\ \text{m})}{(1.5\ \text{m})}$$
$$h_i = -5.0 \times 10^{-2}\ \text{m}$$

Answer: The height of the rabbit's image is **-5.0×10^{-2} m or 5.0×10^{-2} m inverted**.

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 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**

Calculating focal length of lens

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$
$$\frac{1}{f} = \frac{1}{10.0\ \text{cm}} + \frac{1}{6.0\ \text{cm}}$$
$$\frac{1}{f} = 0.266$$
$$f = 3.75\ \text{cm}$$

Calculating distance of image of object in new position

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$
$$\frac{1}{3.75\ \text{cm}} = \frac{1}{3.0\ \text{cm}} + \frac{1}{d_i}$$
$$\frac{1}{d_i} = \frac{1}{3.75\,\text{cm}} - \frac{1}{3.0\,\text{cm}}$$
$$\frac{1}{d_i} = -0.0667$$
$$d_i = -15.0\ \text{cm}$$

Calculating magnification of new image

$$M = -\frac{d_i}{d_o}$$
$$M = -\frac{-15.0\ \text{cm}}{3.0\ \text{cm}}$$
$$M = 5.0$$

Answer: The magnification of the image is **5.0**.

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 uses d_o as 7.0 m for new position.)**

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 or chose an inappropriate procedure; the answer is missing or incorrect, or it is correct purely by chance.

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

Calculating applied force on the horizontal

$$F_{applied} = F \bullet \cos\theta$$
$$= (10.0\ N)\ (\cos 30°)$$
$$= 8.66\ N$$

Calculating net force on block

$$F_{net} = F_{applied} - F_{frictional}$$
$$= 8.66\ N - 0.50\ N$$
$$= 8.16\ N$$

Calculating acceleration on block

$$F_{net} = m \bullet a$$
$$a = \frac{F_{net}}{m}$$
$$a = \frac{8.16\ N}{2.0\ kg}$$
$$a = 4.08\ m/s^2$$

Answer: The magnitude of the acceleration of the block is **4.1 m/s^2**.

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. Incorrect F_{net}.)**

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 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**

Calculating the spring constant Spring constant is the reciprocal of slope of graph

Slope of graph = $\frac{0.5 - 0.25}{20 - 10} = 0.025$ m/N $k = \frac{1}{0.025} = 40$ N/m

Calculating the net force of spring

Force of spring = kx
$F_{spring} = 40 \text{ N/m} \times 0.4 \text{ m} = 16 \text{ N}$

Calculating the frictional force of spring

$F_{spring} = F_{applied} - F_{friction}$
$F_{friction} = F_{applied} - F_{spring}$
$F_{friction} = 25 \text{ N} - 16 \text{ N}$
$F_{friction} = 9.0 \text{ N}$

Answer: The frictional force between the cart and the rough surface is **9.0 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.) **(e.g. Student uses the slope of the graph, 0.025 m/N.)**

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 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**

Distance travelled by car

Distance is area under curve

$$\left(\frac{10\ \text{m/s}\ \text{x}\ 10\,\text{s}}{2}\right) + (10\ \text{m/s} \times 10\ \text{s}) + \left(\frac{10\ \text{m/s}\ +\ 15\ \text{m/s}}{2} \times 10\ \text{s}\right) = 275\ \text{m}$$

Distance travelled by truck

300 m

Difference in distance travelled

300 m – 275 m = 25 m

Answer: The two vehicles are **25 m** apart after 30 seconds.

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 uses the area under curve of truck graph.)**

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 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**

Mechanical advantage of pulley system is 1

Calculating force exerted by horse

$F = ma$

$= (2.5 \times 10^2 \text{ kg})\ (9.8 \text{ m/s}^2)$

$= 2.5 \times 10^3 \text{ N}$

Calculating work done by horse

Work $= F \times d$

$= (2.5 \times 10^3 \text{ N})(3.0 \text{ m})$

$= 7.5 \times 10^3 \text{ J}$

Calculating time exerted to lift load

$$\text{Power} = \frac{\text{Work}}{t}$$

$$t = \frac{\text{Work}}{\text{Power}}$$

$$t = \frac{7.5 \times 10^3 \text{ J}}{7.5 \times 10^2 \text{ W}}$$

$$t = 1.0 \times 10^1 \text{ s}$$

Answer: The horse will take **1.0×10^1 s** to lift the container 3.0 m off the ground.

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 uses a mechanical advantage other than 1.)**

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 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**

Calculating mechanical energy at point C

Mechanical energy $= E_p + E_k$

$= mgh + \frac{1}{2} mv^2$

$= (2.0 \text{ kg}) (9.8 \text{ m/s}^2) (25 \text{ m}) + \frac{1}{2} (2.0 \text{ kg}) (20.0 \text{ m/s})^2$

$= 890 \text{ J}$

Mechanical energy at point C = Mechanical energy at point A

$890 \text{ J} = (2.0 \text{ kg}) (9.8 \text{ m/s}^2) (20.0 \text{ m}) + \frac{1}{2} (2.0 \text{ kg}) (v^2)$

$890 \text{ J} = 392 \text{ J} + \frac{1}{2} (2.0 \text{ kg}) (v^2)$

$v^2 = \frac{(890 \text{ J} - 392 \text{ J})}{\frac{1}{2} (2.0 \text{ kg})}$

$v = \sqrt{498 \text{ m}^2/\text{s}^2}$

$v = 22 \text{ m/s}$

Answer: The speed of the ball at point A was **22 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.) **(e.g. Student calculates wrong mechanical energy.)**

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 or chose an inappropriate procedure; the answer is missing or incorrect, or it is correct purely by chance.

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Physics

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Question Booklet

Secondary 5

August, 2003

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 source of reference 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

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

$$M = \frac{h_i}{h_o}$$

$$\frac{h_i}{h_o} = -\frac{d_i}{d_o}$$

$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$

$$P = \frac{1}{f}$$

$$P_t = P_1 + P_2 + ... + P_n$$

MECHANICS

$$v_{av} = \frac{\Delta d}{\Delta t}$$

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

$$\Delta d = v_1 \Delta t + \frac{1}{2} a(\Delta t)^2$$

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

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

$$P = \frac{W}{\Delta t}$$

$$W = F\ \Delta d$$

$$F_E l_E = F_R l_R$$

$$E_g = mgh$$

$$E_k = \frac{1}{2} mv^2$$

$$F_E \Delta d_E = F_R \Delta d_R$$

$$F = ma$$

$$F_g = mg$$

$$F = kx$$

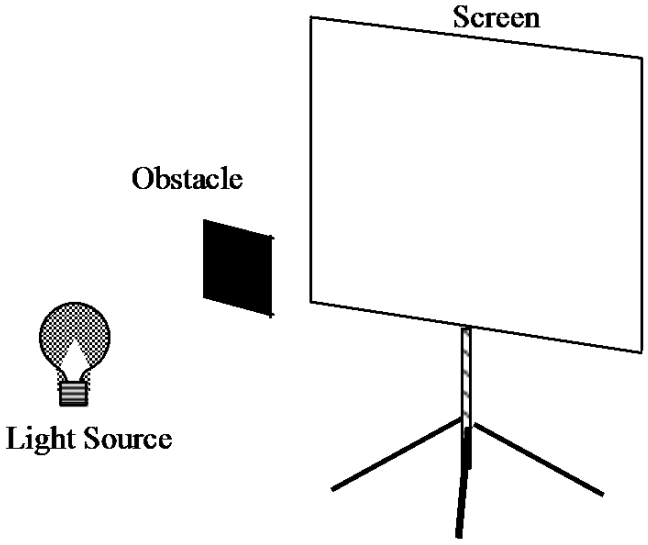
PHYSICAL CONSTANTS

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 on the answer sheet provided.

1 In an laboratory experiment, the following set up was established. The obstacle was then moved closer to the screen, while the light source remained in the same position.



How will the area of the penumbra on the screen change?

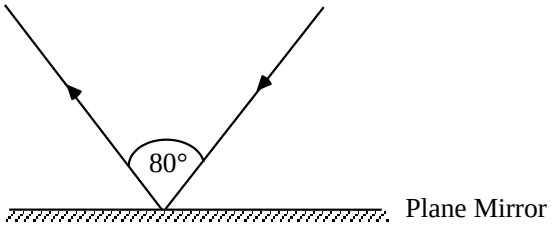
A) The area of the penumbra on the screen will decrease.

B) The area of the penumbra on the screen will remain the same.

C) The area of the penumbra on the screen will increase.

D) The area of the penumbra on the screen will first increase then decrease.

2 The diagram on the right shows a light ray reflected from a plane mirror.



What is the angle of reflection?

A) 100°

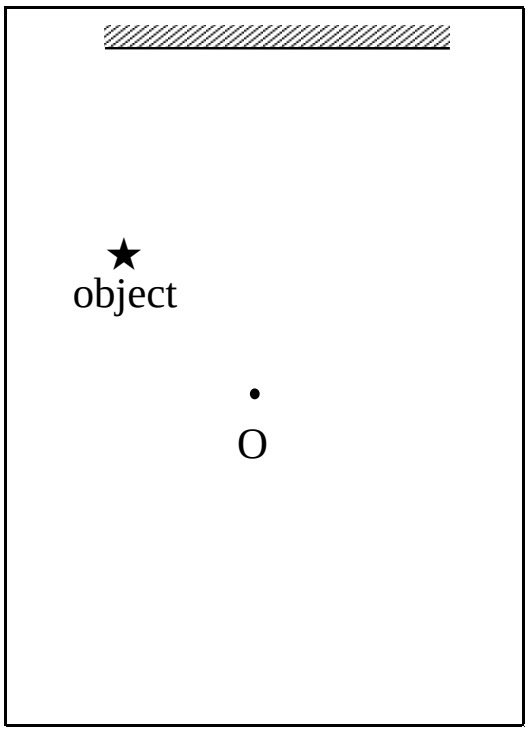
B) 80°

C) 50°

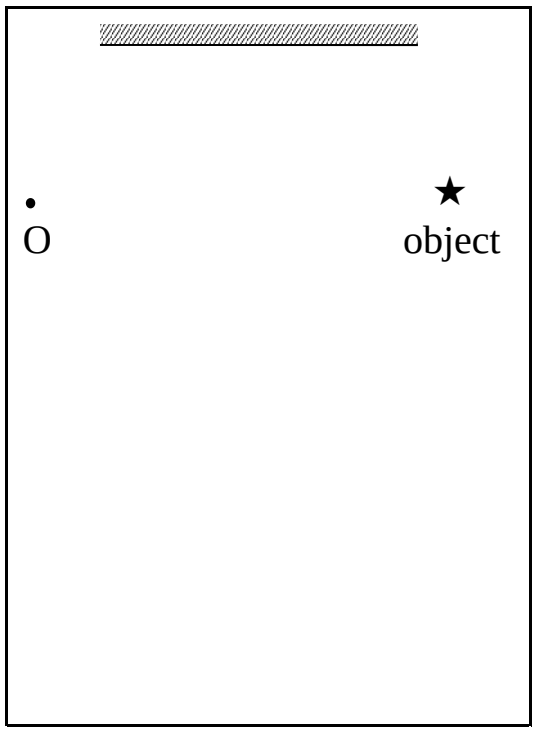
D) 40°

3 **In which of the following situations is the object NOT seen in the mirror by the field of vision of an observer (O)?** (Note: C indicates the centre of curvature)

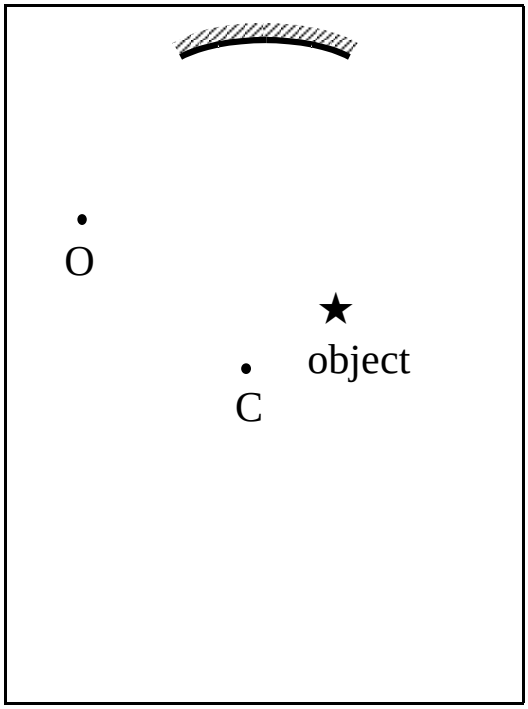
A)



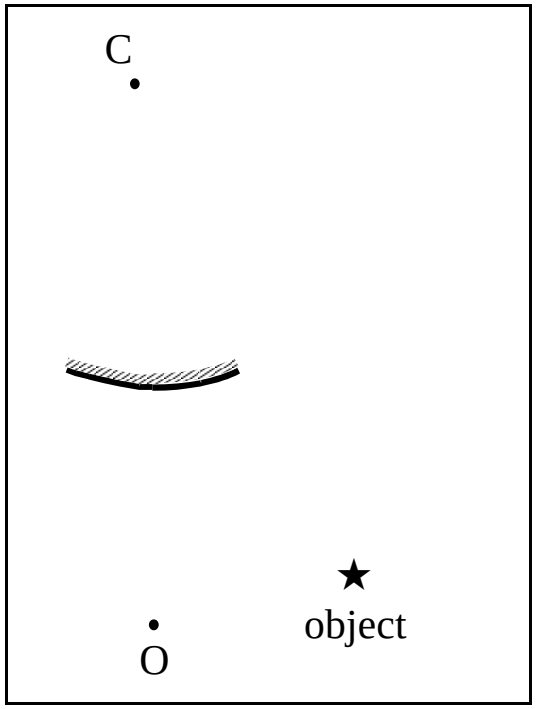
C)



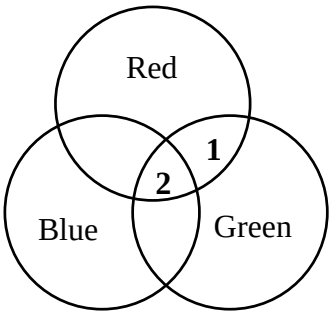
B)



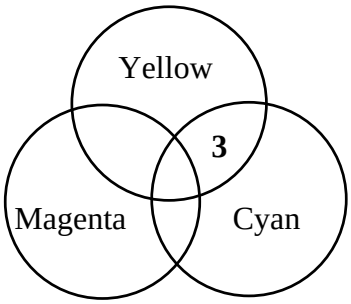
D)



4 The diagrams below illustrate the Additive and Subtractive Theories of Colour.



Additive Theory
(e.g. spotlights)

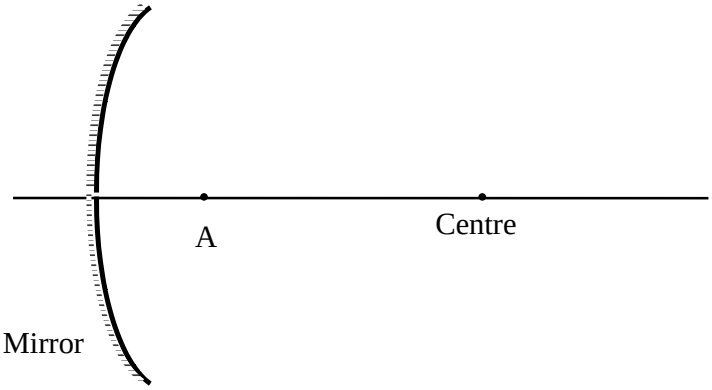


Subtractive Theory
(e.g. mixing paint)

Which of the following combinations correctly identifies the colours of the numbered areas?

	1	2	3
A)	yellow	black	red
B)	cyan	white	green
C)	yellow	white	green
D)	cyan	black	blue

5 An object is placed at point A in front of a concave mirror, as shown in the diagram below.



Which of the following characteristics will the image have?

A) Virtual and inverted

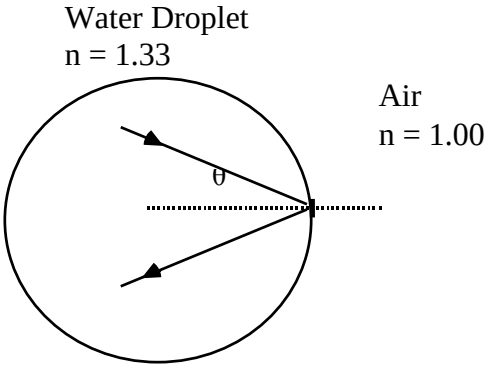
B) Virtual and upright

C) Real and inverted

D) Real and upright

6 The drawing on the right represents a water droplet.

Light, inside the water droplet, hits the surface between water and air.



At what angle (θ) must light hit the surface in order to totally reflect?
(Diagram not drawn to scale)

A) At 48.8°

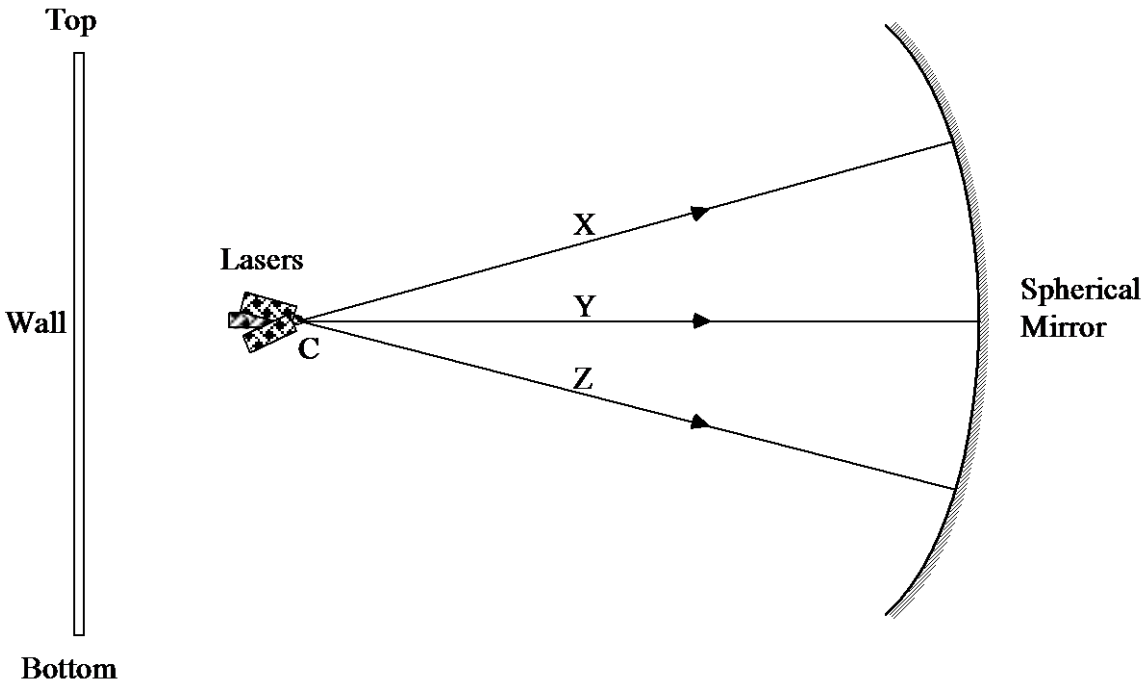
B) At an angle greater than 48.8°

C) At an angle less than 48.8°

D) At any angle between 0° and 90°

7 Three lasers are placed such that the laser beams pass through the centre of curvature of a large spherical concave mirror. The lasers are switched on and pointed at the mirror.

The path of their light beams (X, Y, Z) is shown in the diagram below.



How will the reflected beams behave?

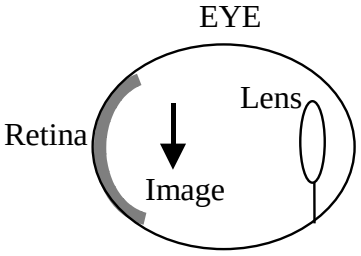
A) The three laser beams will be reflected and appear as three spots on the wall, with beam X on the top and beam Z on the bottom.

B) The three laser beams will be reflected and appear as one spot on the wall.

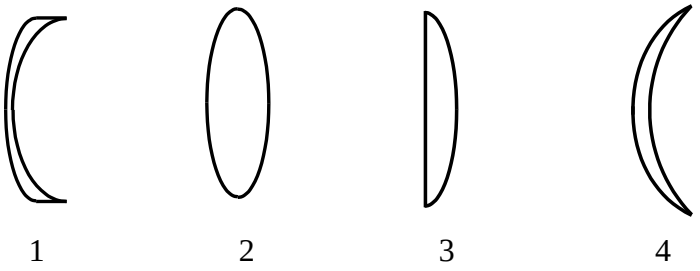
C) The three laser beams will be reflected but never appear anywhere on the wall.

D) The three laser beams will be reflected and appear as three spots on the wall, with beam Z on the top and beam X on the bottom.

8 Alison is having difficulty reading the blackboard from the third row in the classroom. She has myopia. The image of a distant object forms in front of the retina of her eye, as shown in the diagram below.



Which lens would correct her visual difficulty?



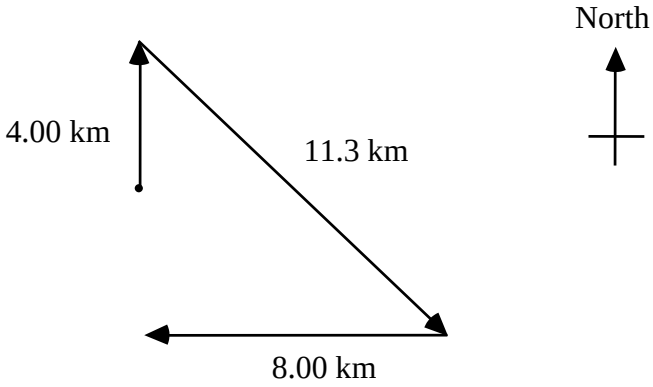
A) Lens 1

B) Lens 2

C) Lens 3

D) Lens 4

9 In a map-reading exercise several students were given the following directions: From your starting point walk 4.00 km North, then 11.3 km 45° South of East, [S45°E], and finally 8.00 km West. This is illustrated in the vector diagram below.



What was the students' displacement for this trip?

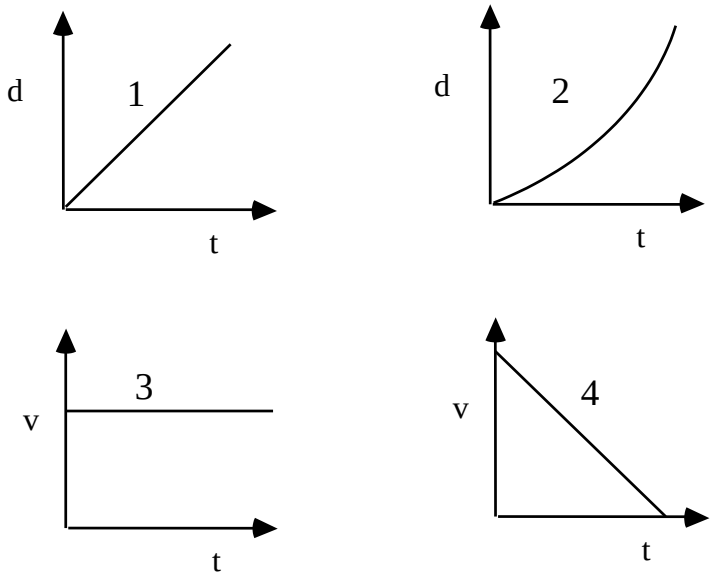
A) 4.00 km North

B) 4.00 km South

C) 23.3 km North

D) 23.3 km South

10 **Which of the following graphs illustrate non-uniform motion?**



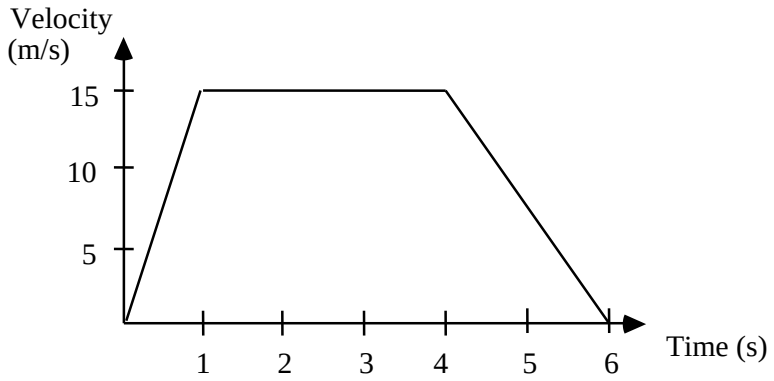
A) Graphs 1 and 2

B) Graphs 1 and 3

C) Graphs 2 and 4

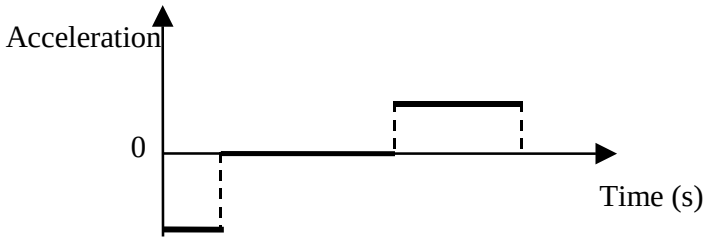
D) Graphs 3 and 4

11 The following velocity-time graph represents the motion of a panoramic elevator as it makes its way up from the main floor to the top floor of an observation tower.

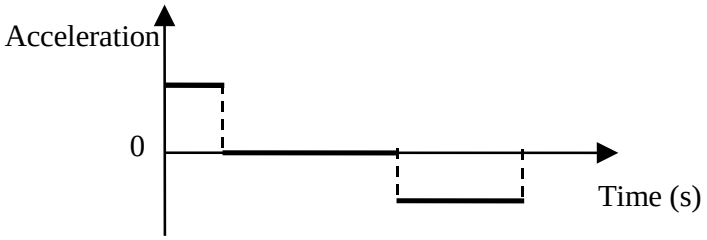


Which of the graphs below represents the acceleration of this elevator as it makes its way up to the top of the tower?

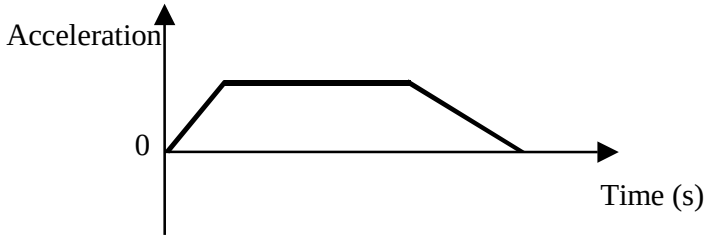
A)



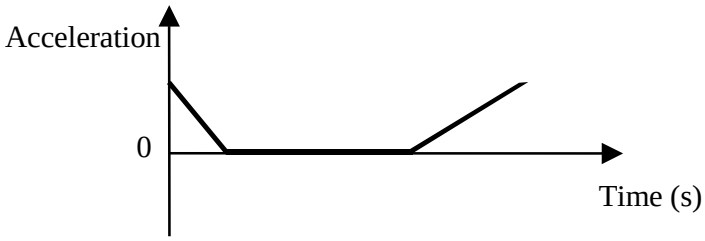
B)



C)



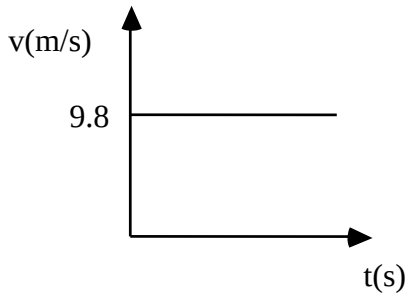
D)



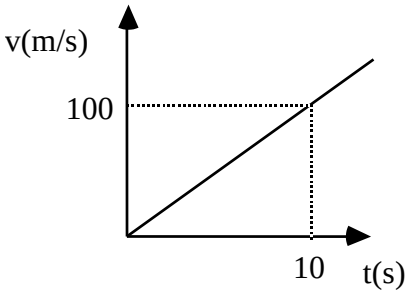
12 The gravitational pull of Mars is approximately $\frac{4}{10}$ the gravitational pull of Earth.

Which of the following velocity-time graphs represents the motion of a falling object on Mars?

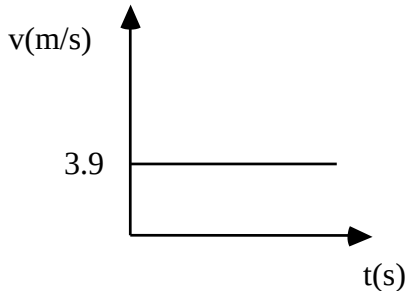
A)



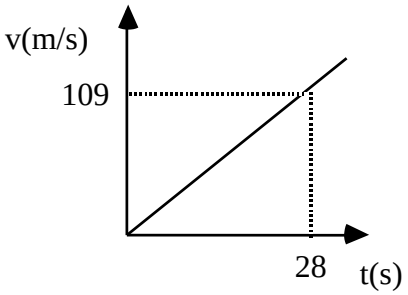
C)



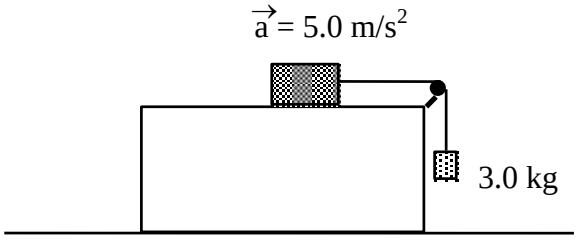
B)



D)



13 A 3.0 kg mass is suspended from a block placed on a table. The block then experiences an acceleration of 5.0 m/s^2.



What is the mass of the block? (Neglect friction)

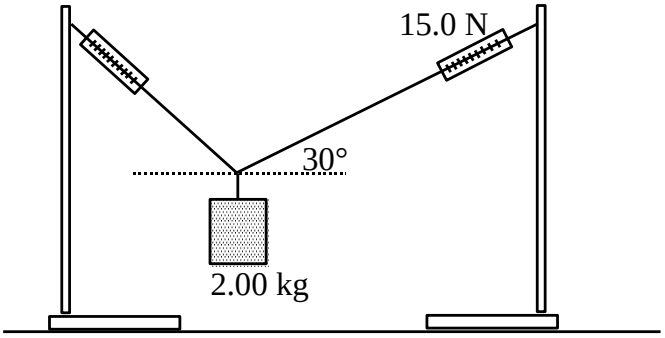
A) 1.7 kg

B) 2.9 kg

C) 5.9 kg

D) 8.0 kg

14 A 2.00 kg mass is suspended between two stands. The force measured by one spring scale is 15.0 N at 30° to the horizontal.



Which reading below would appear on the second scale?

A) 17.8 N
C) 9.98 N
B) 13.4 N
D) 4.60 N

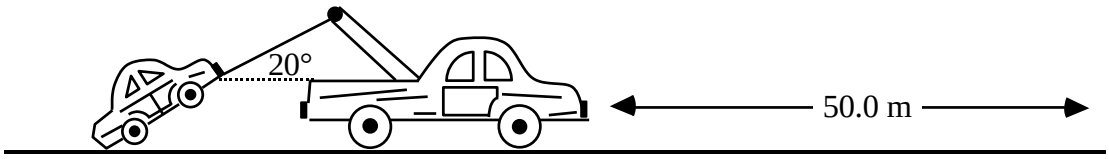
15 An object weighing 49 N on Earth is taken to planet X. The object on planet X weighs 4.0×10^1 N.

What is its acceleration due to gravity on planet X?

A) 0.13 m/s^2
C) 1.3 m/s^2
B) 0.80 m/s^2
D) 8.0 m/s^2

16 A 5.0×10^3 N car is towed 50.0 m horizontally by a tow truck.

The tow truck applies a force of 2.0×10^3 N at an angle of 20° to the horizontal for 5.0 seconds.

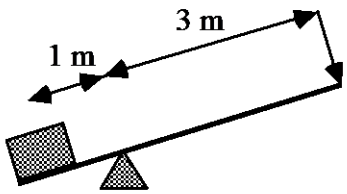


How much power does the tow truck exert?

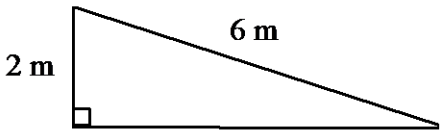
A) 5.0×10^4 W
C) 2.0×10^4 W
B) 4.7×10^4 W
D) 1.9×10^4 W

17 **Which of the following simple machines have a mechanical advantage of 3?**

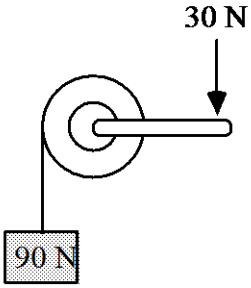
1.



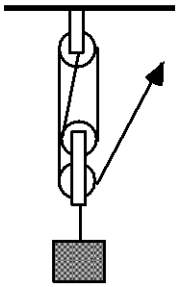
2.



3.



4.



A) Simple machines 1 and 4

B) Simple machines 2 and 3

C) Simple machines 1, 2 and 3

D) Simple machines 2, 3 and 4

18 A car increases its speed from 31 km/h to 93 km/h.

By which factor below will the kinetic energy be increased?

A) 0.33

B) 2.0

C) 3.0

D) 9.0

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; however, significant figures will not be considered.

Part B

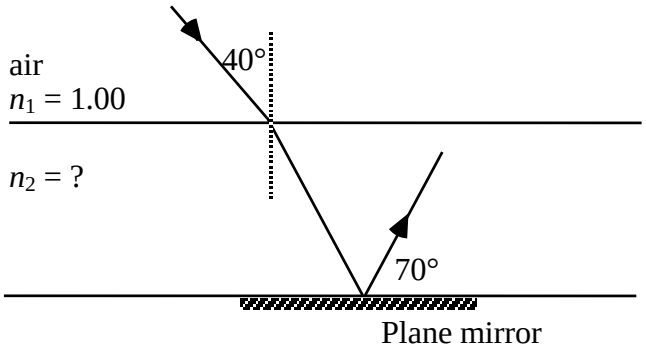
Questions 19, 20, 21 and 22
Choose any **three** of these questions and answer them in the answer booklet.

19 A system of three lenses is found to have a power of 15 diopters.
Data for two of the lenses is given below.

Lens	Focal Length (m)
A	0.05
B	0.20
C	?

Determine the focal length of lens C in metres.

20 Light passes from air into an unknown medium and is reflected from a plane mirror.

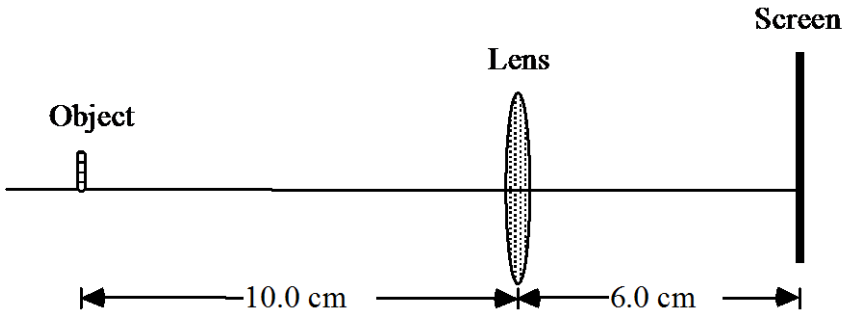


What is the index of refraction (n_2) for the unknown medium?

21 A rabbit 0.10 m in height is located 1.5 m from a converging lens with a focal length of 0.50 m.

What is the height of the rabbit's image?

22 When an object is placed 10.0 cm in front of a converging lens, an image, 6.0 cm behind the lens, appears on a screen. The object is subsequently moved 7.0 cm closer to the lens.

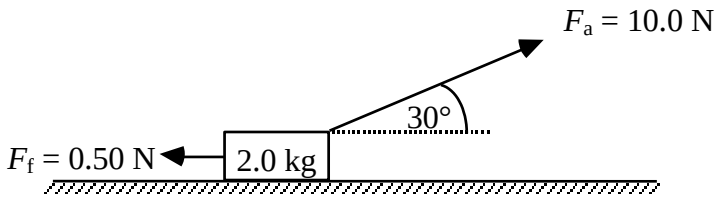


What will be the magnification of the image after the move?

Part C

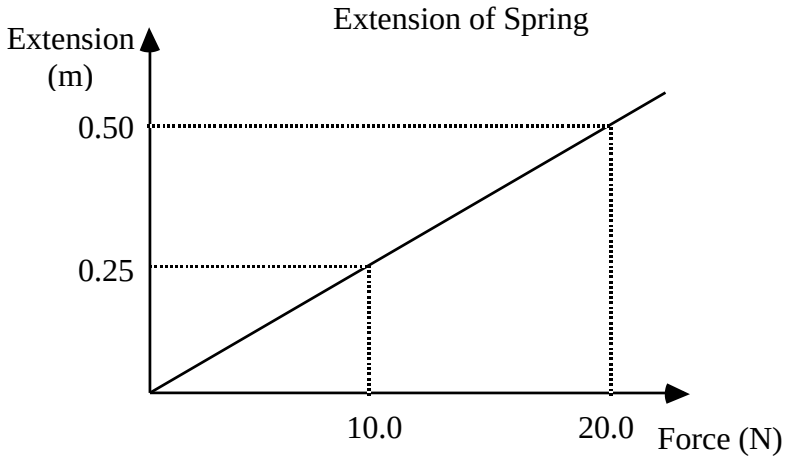
Questions 23, 24, 25, 26 and 27
Choose any **four** of these questions and answer them in the answer booklet.

23 A force of 10.0 N is applied at an angle of 30° with the horizontal to a 2.0 kg block resting on a surface. The force of friction between the block and the surface is 0.50 N.

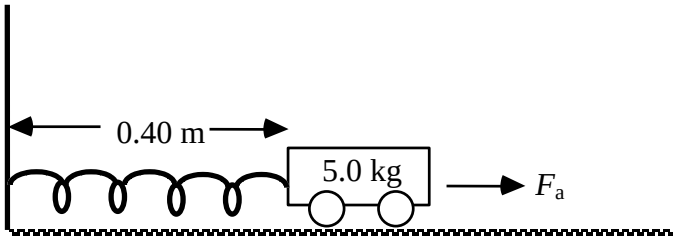


What is the magnitude of the acceleration of the block?

24 A student applies various weights to a spring and obtains the following results:

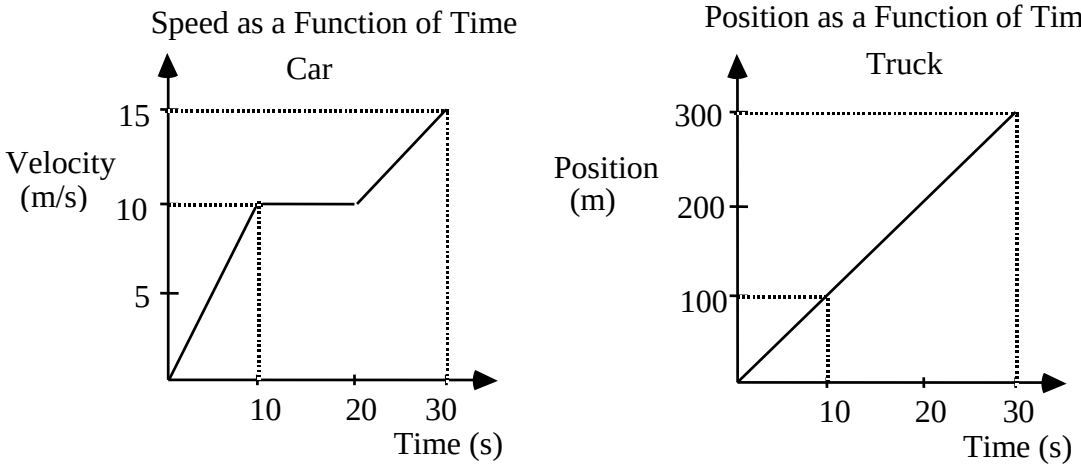


The student then takes the spring and attaches it to a 5.0 kg cart on a rough flat surface. A 25 N force is applied and the spring extends 0.40 m.



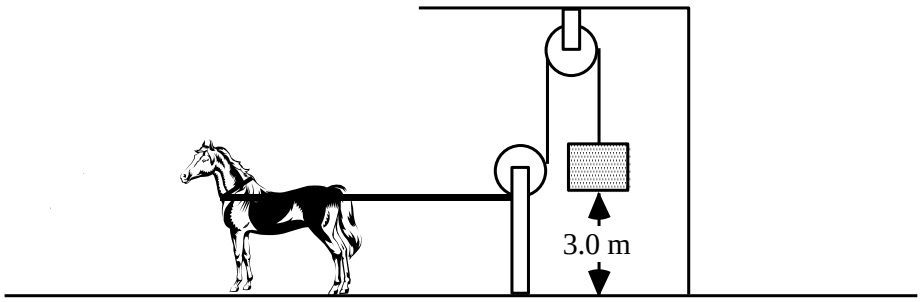
What is the frictional force between the cart and the rough surface?

25 A car and a truck leave a traffic light at the same time, travelling in the same direction. The graphs below illustrate their motions.



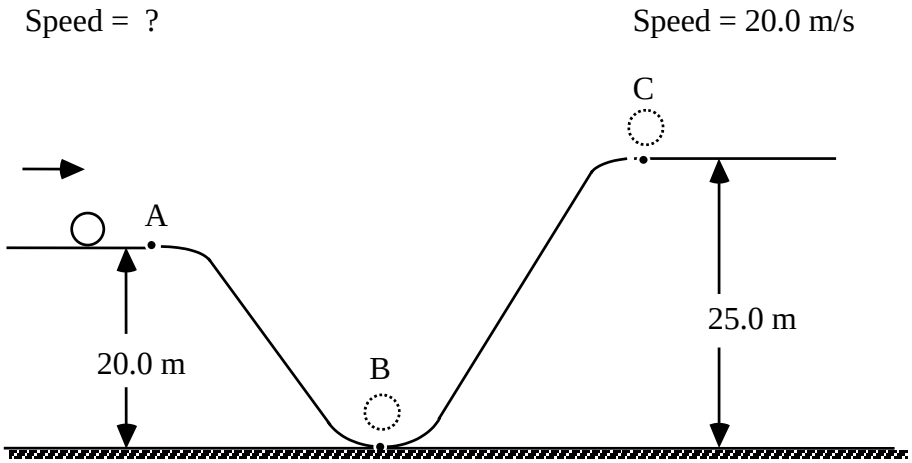
How many metres apart are the two vehicles after 30 seconds?

26 A working horse lifts a 2.5×10^2 kg container 3.0 m off the ground with the help of a pulley system. The horse exerts a power of 7.5×10^2 W to do this work.



How long does it take the horse to raise the container 3.0 m off the ground?
(Neglect friction.)

27 A 2.0 kg ball rolls along a frictionless surface, as illustrated below. It passes point C at a speed of 20.0 m/s.



What was the speed of the ball at point A?

GRICS

554-534

Physics

Comprehensive Exam
Number 53

Answer Booklet

Secondary 5

August, 2003

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

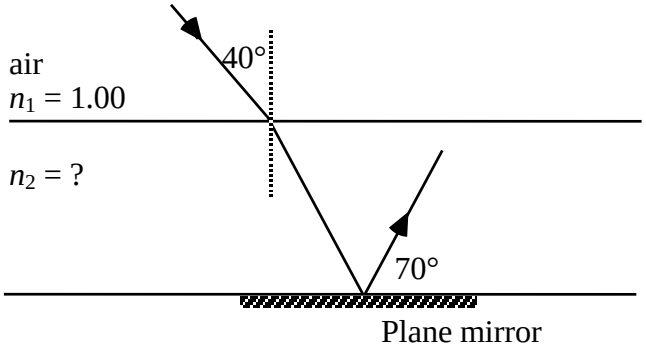
SHOW ALL YOUR WORK

Answer: The focal length of lens C is _____m.

4	3	2	1	0

20

SHOW ALL YOUR WORK



Answer: The index of refraction of the unknown medium is _____.

4	3	2	1	0

21

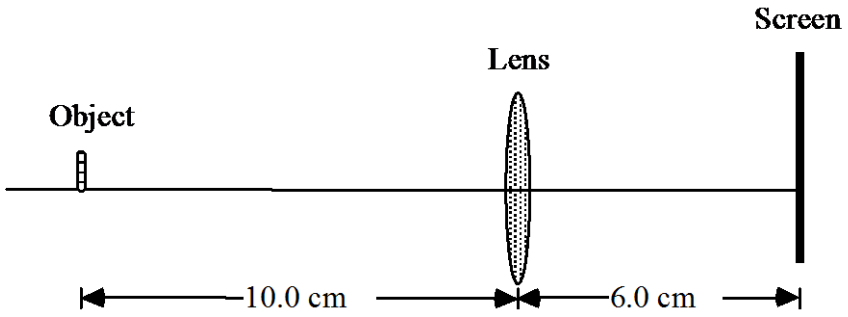
SHOW ALL YOUR WORK

Answer: The height of the rabbit's image is _____ m.

4	3	2	1	0

22

SHOW ALL YOUR WORK



Answer: The magnification of the image is _____.

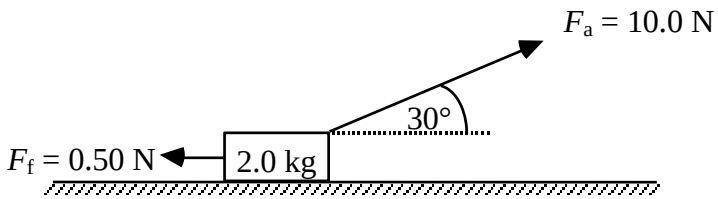
4	3	2	1	0

PART C

Questions 23, 24, 25, 26 and 27
Choose any **four** of these questions and answer them in this 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

SHOW ALL YOUR WORK

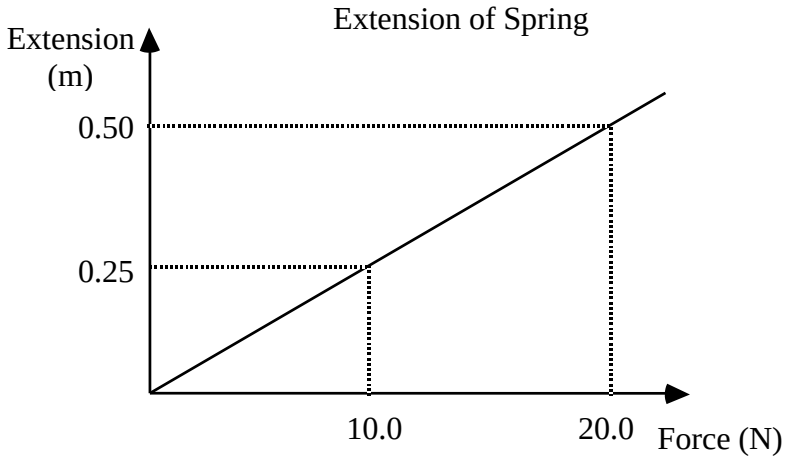


Answer: The magnitude of the acceleration of the block is _____ m/s^2.

4	3	2	1	0

24

SHOW ALL YOUR WORK

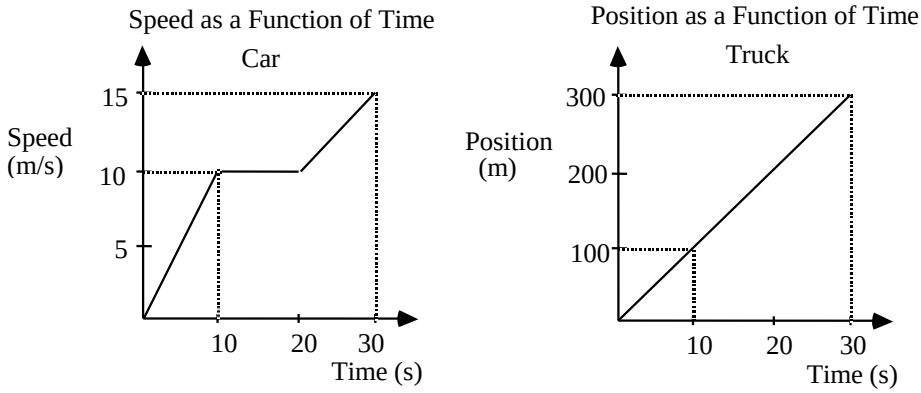


Answer: The frictional force between the cart and the rough surface is _____ N.

4	3	2	1	0

25

SHOW ALL YOUR WORK

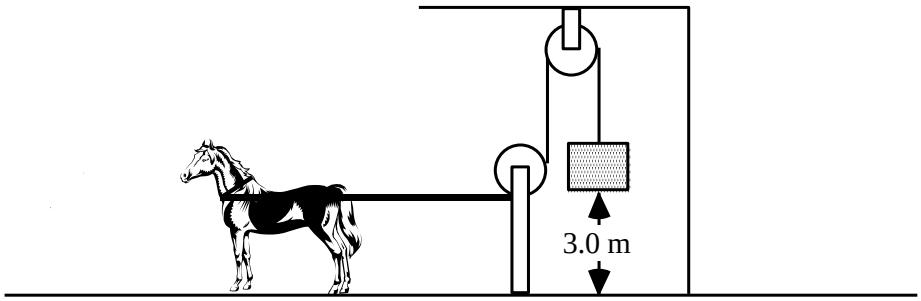


Answer: The two vehicles are _____ m apart after 30 sconds.

4	3	2	1	0

26

SHOW ALL YOUR WORK

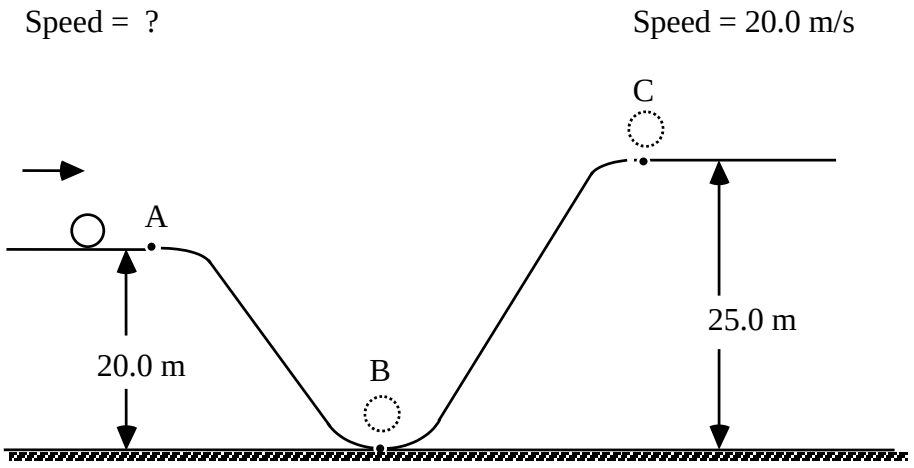


Answer: The horse will take _____ s to lift the container 3.0 m off the ground.

4	3	2	1	0

27

SHOW ALL YOUR WORK



Answer: The speed of the ball at point A was _____ m/s.

4	3	2	1	0