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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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# Level 2 Science, 2008

## 90768 Use physics concepts and principles to describe the behaviour of light

Credits: Four
9.30 am Thursday 20 November 2008

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should answer ALL the questions in this booklet.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–8 in the correct order and that none of these pages is blank.

**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**

| *For Assessor's use only* | **Achievement Criteria** | | | | |
|---|---|---|---|---|---|
| **Achievement** | | **Achievement with Merit** | | **Achievement with Excellence** | |
| Use physics concepts and principles to describe the behaviour of light. | | Use physics concepts and principles to explain the behaviour of light. | | Use physics concepts and principles to discuss the behaviour of light. | |
| **Overall Level of Performance** | | | | | |

You are advised to spend 40 minutes answering the questions in this booklet.

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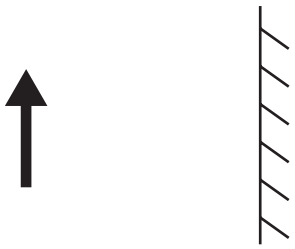
## QUESTION ONE: PLANE MIRROR

(a) Draw rays to complete the ray diagram below. Use the rays you have drawn to show the image of the arrow.



(b) Use the properties of a plane mirror image to discuss why a plane mirror is not suitable to use in a camera to reflect the image onto the film.

## QUESTION TWO: CURVED MIRRORS

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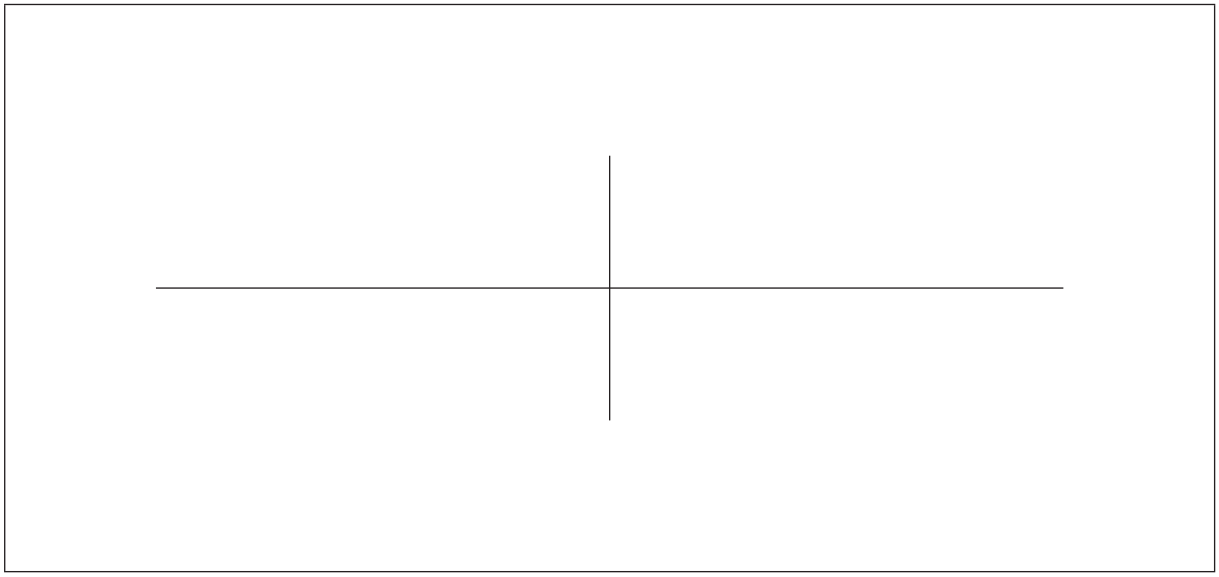
(a) An object 10 cm high is placed 20 cm from a concave mirror of focal length 40 cm.

Use a **scale** diagram to find the **size**, **position** and **nature** of the image.



Size: _____

Position: _____

Nature: _____

A concave mirror can be used to shave or apply make-up.

In order to get the full benefit from the mirror, the person needs to position their face inside the focal length of the mirror.

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http://farm1.static.flickr.com/70/435720802_b819454735.jpg?v=0

(b) Describe why it would be beneficial to use a concave mirror for shaving or applying make-up.

_____

_____

(c) Use **relevant ray diagrams** to justify why the person's face needs to be inside the focal length of the mirror.

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## QUESTION THREE: LENSES

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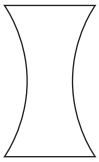
Lenses are commonly bi-convex  or bi-concave 

These lenses can form real and/or virtual images.

Compare and contrast the **types of images** formed by each of these lenses. Include ray diagrams for each type of lens and show F and 2F in your diagrams.

## QUESTION FOUR: GEMSTONES

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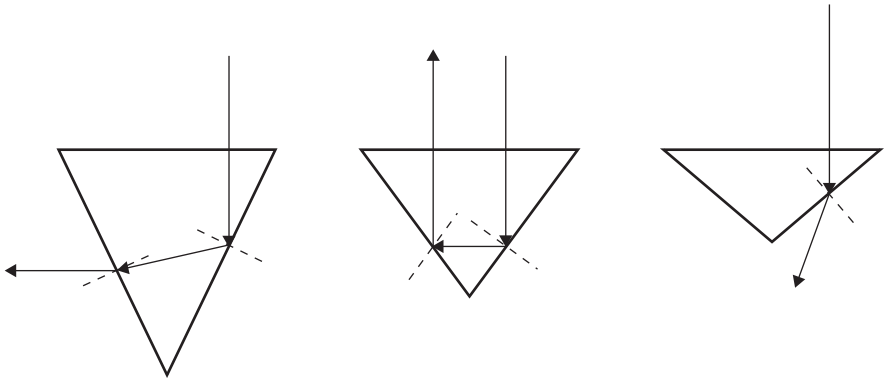
The brilliance of gemstones relies on light bouncing around inside the gem. Three different gemstones are cut with differing angles as shown below.



A. Cut too deep B. Well cut C. Cut too shallow

When light enters a transparent medium, factors affecting the path of the light ray include:

- speed, $v$
- wavelength, $\lambda$
- refractive index of material
- critical angle
- total internal reflection.

(a) Gemstone B is considered to be well cut, compared to gemstones A and C.

Compare and contrast the path of the light rays through the three gemstones, A, B, and C to show why gemstone B is considered to be well cut.

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(b) Blue light has a frequency, $f$, of $6.4 \times 10^{14}$ Hz, and it has a wavelength, $\lambda$, of $4.7 \times 10^{-7}$ m in air.

Use $v = f\lambda$ to find the velocity, $v$, of light in air, and then use your answer to find the wavelength of red light of frequency $4.4 \times 10^{14}$ Hz.

**Extra paper for continuation of answers if required.**
**Clearly number the question.**

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Question number