Reflection, Refraction and Lenses (MCQ Only)

Q1.

Light travelling in glass of refractive index n_g is incident at a boundary with water of refractive index n_w. The critical angle for the boundary is C.

Which of the following expressions is correct for this boundary?

☒ **A** $\sin C = \dfrac{1}{n_g}$

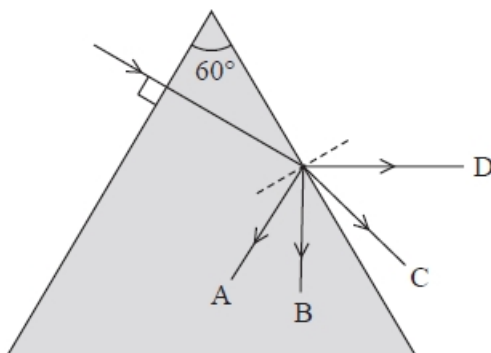☒ **B** $\sin C = \dfrac{n_w}{n_g}$

☒ **C** $\sin C = \dfrac{n_g}{n_w}$

☒ **D** $\sin C = \dfrac{1}{n_w}$

(Total for question = 1 mark)

Q2.

A ray of light, in air, is incident on the edge of a triangular glass prism as shown. The critical angle for a light ray meeting a glass to air boundary is 35°.

Which of the following gives the value of the refractive index of the glass?

☒ **A** $\sin 35$

☒ **B** $\dfrac{1}{\sin 35}$

☒ **C** $\sin^{-1}\left(\dfrac{1}{35}\right)$

☒ **D** $\dfrac{1}{\sin^{-1}\left(\dfrac{1}{35}\right)}$

(Total for question = 1 mark)

Q3.

An object is placed 6.5 cm from a lens of focal length 3.9 cm. An image is formed 9.8 cm behind the lens.

Which of the following expressions is equal to the magnification?

☒ **A** $\dfrac{3.9}{6.5}$

☒ **B** $\dfrac{6.5}{9.8}$

☒ **C** $\dfrac{6.5}{3.9}$

☒ **D** $\dfrac{9.8}{6.5}$

(Total for question = 1 mark)

Q4.

An object is placed in front of a lens.

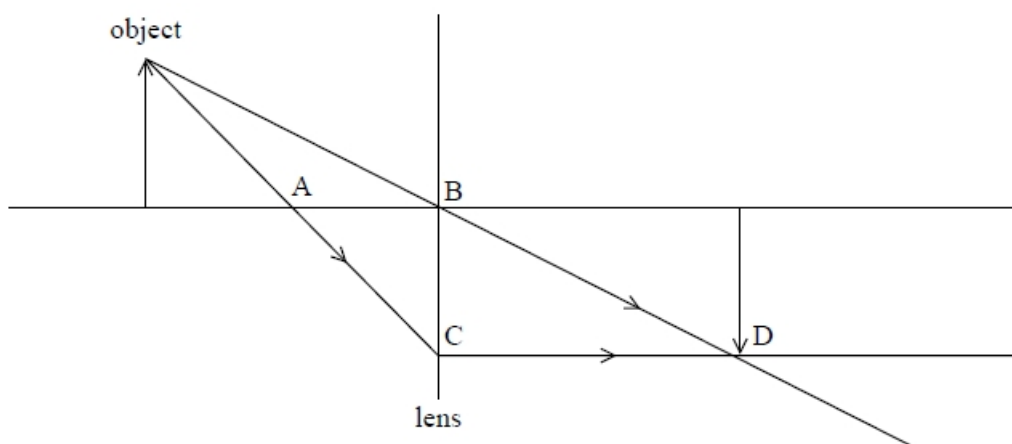Which row of the table shows a combination that will produce a real image of the object?

		Focal length of lens/cm	Object distance/cm
☒	A	−5	10
☒	B	−5	2
☒	C	5	10
☒	D	5	2

(Total for question = 1 mark)

Q5.

The diagram shows how an image is formed by an object that is placed a small distance from a thin converging lens.

Which of the labels A, B, C or D represents the focal point of the lens?

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for question = 1 mark)

Q6.

A diverging lens is used to produce an image of a real object.

Select the row of the table that correctly identifies the nature of the image produced.

☐ A	Real	Upright
☐ B	Real	Inverted
☐ C	Virtual	Upright
☐ D	Virtual	Inverted

(Total for question = 1 mark)

Q7.

A ray of light, in air, is incident on the edge of a triangular glass prism as shown.
The critical angle for a light ray meeting a glass to air boundary is 35°.
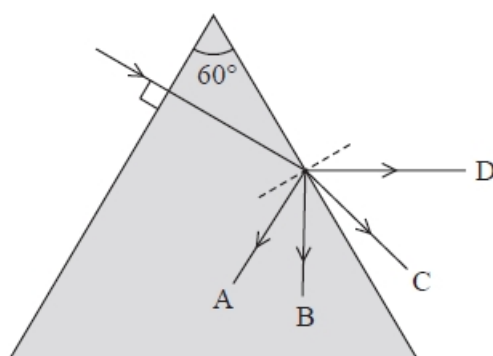
Which path, A, B, C or D, will the ray follow?

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for question = 1 mark)

Q8.

An object is placed 6.5 cm away from a lens of focal length 3.9 cm. An image is formed 9.8 cm from the lens.

Which of the following is the magnification?

(1)

☒ **A**   0.60

☒ **B**   0.66

☒ **C**   1.5

☒ **D**   1.7

(Total for question = 1 mark)

Q9.

A converging lens is used as a magnifying glass. An image is produced that is 30 cm away from the lens and twice as big as the object.
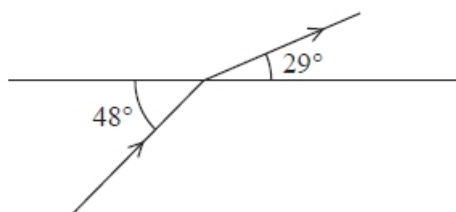
Choose the row that correctly identifies the nature of the image and the object distance.

	Nature of image	Object distance/cm
☐ A	real	15
☐ B	real	60
☐ C	virtual	15
☐ D	virtual	60

(Total for question = 1 mark)

Q10.

The diagram shows a ray of light travelling from a transparent medium into air.

The refractive index of the transparent medium is given by

☒ **A**   sin 48° / sin 29°

☒ **B**   sin 42° / sin 29°

☒ **C**   sin 61° / sin 48°

☒ **D**   sin 61° / sin 42°

(Total for question = 1 mark)

Q11.

A wave of wavelength λ and frequency f is travelling in a medium with wave speed v_1.
The wave passes into another medium with wave speed v_2.

The wavelength of the wave in the second medium is

☒ **A** $\dfrac{v_1}{f}$

☒ **B** $\dfrac{v_2}{f}$

☒ **C** $\dfrac{v_1}{v_2 f}$

☒ **D** $\dfrac{v_2 f}{v_1}$

(Total for question = 1 mark)

Q12.

A system of lenses consists of a converging lens and a diverging lens in contact.

The magnitude of the power of the converging lens is 9.4 D and the magnitude of the power of the diverging lens is 4.2 D.
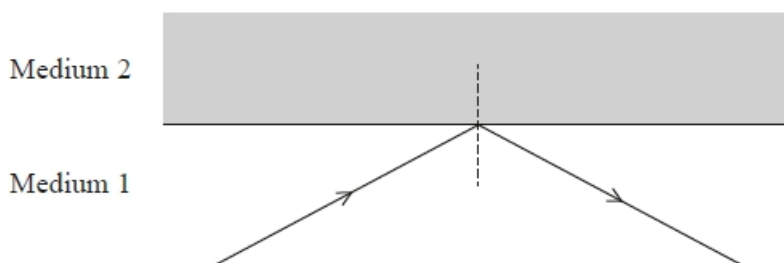
Which of the following is the power of this system of lenses?

☒ **A**   13.6 D

☒ **B**   5.2 D

☒ **C**   −5.2 D

☒ **D**   −13.6 D

(Total for question = 1 mark)

Q13.

A ray of light travels through medium 1 of refractive index n_1 and is incident at an interface with medium 2 of refractive index n_2. The ray is totally internally reflected at the interface.

speed of the light in medium 1 = v_1

speed of the light in medium 2 = v_2

Which row of the table is correct for this situation?

☒ **A**	$v_1 > v_2$	$n_1 > n_2$
☒ **B**	$v_1 < v_2$	$n_1 > n_2$
☒ **C**	$v_1 > v_2$	$n_1 < n_2$
☒ **D**	$v_1 < v_2$	$n_1 < n_2$

(Total for question = 1 mark)

Q14.

The focal length and power of a converging glass lens are determined for the lens in air. The lens is then immersed in water.

Which row in the table shows how the focal length and power of the lens change?

		Focal length	Power of lens
☒	A	decreases	decreases
☒	B	decreases	increases
☒	C	increases	decreases
☒	D	increases	increases

(Total for question = 1 mark)

Q15.

For total internal reflection to take place, the angle of incidence must be

☒ **A** greater than or equal to the critical angle.

☒ **B** greater than the critical angle.

☒ **C** less than or equal to the critical angle.

☒ **D** less than the critical angle.

(Total for question = 1 mark)

Mark Scheme – Reflection, Refraction and Lenses (MCQ Only)

Q1.

Question Number	Answers	Mark
	The only correct answer is B *A is incorrect because the relative refractive index for light travelling from glass to water is required* *C is incorrect because the relative refractive index for light travelling from glass to water is required* *D is incorrect because the relative refractive index for light travelling from glass to water is required*	1

Q2.

Question Number	Answer	Mark
	$B \dfrac{1}{\sin 35}$	1
	Incorrect Answers: A – incorrect arrangement of equation C – incorrect arrangement of equation D – incorrect arrangement of equation	

Q3.

Question Number	Acceptable answers	Additional guidance	Mark
	The only correct answer is **D** because magnification is numerically equal to image distance divided by object distance A is not correct because magnification is numerically equal to image distance divided by object distance, but this is focal length divided by object distance B is not correct because magnification is numerically equal to image distance divided by object distance, but this is object distance divided by image distance C is not correct because magnification is numerically equal to image distance divided by object distance, but this is object distance divided by focal length		1

Q4.

Question Number	Answer	Mark
	The only correct answer is C because 10 cm is more than the focal length from a converging lens A diverging lenses do not form real images from real objects B diverging lenses do not form real images from real objects D an object at less than the focal length from a converging lens will form a virtual image	1

Q5.

Question Number	Acceptable Answers	Additional Guidance	Mark
	A		1

Q6.

Question Number	Acceptable answers	Additional guidance	Mark
	C		1

Q7.

Question Number	Answer	Mark
	B – TIR as angle of incidence is greater than the critical angle	1
	Incorrect Answers: A – light is reflecting at an incorrect angle C – light is not refracted D – light is not refracted	

Q8.

Question Number	Answer	Mark
	C - 1.5	1
	Incorrect Answers: all select incorrect data from question Correct method: image distance ÷ object distance A – uses focal length ÷ object distance B – uses object distance ÷ image distance D – uses object distance ÷ focal length	

Q9.

Question Number	Acceptable answers	Additional guidance	Mark
	C		1

Q10.

Question Number	Answers	Additional Guidance	Mark
	D	sin 61° / sin 42°	(1)

Q11.

Question Number	Answer	Additional guidance	Mark
	B	$\left(\frac{v_2}{f}\right)$	(1)

Q12.

Question Number	Acceptable answers	Additional guidance	Mark
	The only correct answer is B because the power of a diverging lens is negative, so the total power $= 9.4\,D - 4.2\,D = 5.2\,D$ A is not correct because the total power should be obtained from $(9.4\,D - 4.2\,D)$, but this is $(9.4\,D + 4.2\,D)$ C is not correct because this is $(4.2\,D - 9.4\,D)$ using negative power for a converging lens and positive for a diverging lens where it should be the opposite so that $(9.4\,D - 4.2\,D)$ is used D is not correct because $-13.6\,D = -9.4\,D - 4.2\,D$, as if both lenses are diverging, which is not the case		1

Q13.

Question Number	Answer			Mark
	B	$v_1 < v_2$	$n_1 > n_2$	1
	Incorrect Answers: A – incorrect equality for speed C – incorrect equality for speed and refractive index D – incorrect equality for refractive index			

Q14.

Question Number	Answers	Mark
	The only correct answer is **C** *A is incorrect because the focal length of the lens increases* *B is incorrect because the focal length of the lens increases* *D is incorrect because lens power is the reciprocal of the focal length*	1

Q15.

Question Number	Acceptable answers	Additional guidance	Mark
	The only correct answer is **B** because at angles less than or equal to the critical angle not all of the light is reflected internally such that angle of incidence is equal to the angle of reflection A is not correct because total internal reflection occurs at angles greater than the critical angle but at the critical angle the angle of refraction is 90 degrees, so the reflection is not total C is not correct because internal reflection is not total at angles less than the critical angle D is not correct because internal reflection is not total at angles less than the critical angle		1