This marking key is constructed so that it can be used for summative purposes. Possible answers to each question are provided in italics. The allocation of marks to student answers enables a test score out of 26 to be calculated, which can be used for grading and reporting. Teachers may wish to modify the electronic version of the test and marking key to suit local outcomes and assessment policies.

1. A man is sitting in a room with a cat.
   The room has no window and the door is closed.
   The only source of light is an electric light globe.

   When the light is switched on:
   a. How does the light help the man see the cat? (2 marks)
      You may wish to draw arrows on the diagram to help explain.
      States that light from the globe bounces off the cat into the man’s eye. (1)
      Draws light ray arrows on the diagram to show light from the globe reflecting off
      the cat into the man’s eye. (1)

      When the light is switched off and there is no light in the room:
   b. Can the man see the cat? Explain. (2 marks)
      No. You can’t see without light. (1)
      Light rays are needed to form an image in the eye. (1)

   c. Can the cat see the man? Explain. (1 mark)
      No. Cats can’t see without light. (1)

2. Jordan and Kylie are looking into a mirror.
   a. Can Jordan see an image of the box in the mirror? Explain. (3 marks)
      You may wish to draw arrows on the diagram to help explain.
      Yes. Light from the box can bounce off the mirror into Jordan’s eye so he can
      see it. (1)
      Constructs light rays to show reflected light enabling Jordan to see the box. (1)
      Ray diagram shows light from the box striking the mirror at a point where the
      equal angles of incidence and reflection allow the light to reach Jordan’s eye.
      (1)

   b. Can Kylie see an image of the box in the mirror? Explain. (3 marks)
      No. The position of the box and mirror do not allow light from the box to reflect
      back to Kylie. (1)
      Constructs light rays to show light from the box strike the mirror and reflect
      away from Kylie. (1)
      Ray diagram constructed with equal angles of incidence and reflection. (1)
3. The rear view mirror in your car has been broken and you need to make a temporary repair. You only have access to a spherical (round) concave mirror and a spherical convex mirror. Would either of these be suitable? Explain. (2 marks)

The convex mirror would be better than the concave mirror as convex mirrors produce upright images and convex mirrors produce upside down images.

(1)

A flat/plane mirror is ideal as it produces an upright image as far behind the mirror as the object is in front of the mirror and therefore gives a true indication of how close the car behind is to you. (1)

OR

Images produced by spherical mirrors are not the same distance from the mirror as the object and therefore do not give a true indication of how far away the object is. (1)

4. Convex lenses are used in many optical instruments eg cameras, projectors and magnifying glasses.

a. What effect does a convex lens have on light rays? (1 mark)

Convex lenses bend light rays so they converge to a point/focus. (1)

b. Draw a diagram to show how a convex lens can be used to burn a piece of paper. (1 mark)

Draws a ray diagram to show how a convex lens converges parallel light rays to a point. (1)

5. When sunlight shines through the corner of an aquarium the light rays are bent.

a. Complete the diagram to show the path of the light ray. (2 marks)

Diagram shows the ray bends away from the surface (towards the normal) as it enters the water (1), and towards the surface (away from the normal) as it leaves the water. (1)
b. Explain why light rays bend when they pass from one medium to another (eg from air to glass), striking the boundary between the two media at an angle. **(3 marks)**

- Light travels more slowly in glass than in air. (1)
- When the light strikes the surface at an angle the rays that hit the glass first are slowed down before the other rays. (1)
- Because the different rays travel at different speeds the bundle of rays bend. (1)

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c. When white light passes through the corner of an aquarium or through a glass prism a spectrum of colours may be formed. Why does white light break up into colours under these circumstances? **(3 marks)**

- Different colours bend different amounts and therefore white light breaks up into its colours as it comes out of a prism. (1)
- Draws a ray diagram to show differential bending. (1)
- As different colours travel at different speeds in glass, when white light strikes the surface of glass, the light disperses into its colours because different colours bend different amounts, red light bends (refracts) least and violet the most, thus producing a spectrum. (1)

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6. Design an optical instrument that can be used to look up over a wall and project an image on to a screen. Draw a diagram to show the parts of the instrument and the path along which light will travel through the instrument. **(3 marks)**

- Designs an instrument that will work eg periscope made of two mirrors with a lens added to focus the light emerging from the periscope onto a screen. (1)
- Draws a ray diagram that correctly shows the effect of the mirrors and lens on the light ray path. (2)